AFFTC-TIM-08-07

Compatibility Flight Profile and Internal Environment Characterization for the RASCAL Pod

PROJECT: Senior RASCAL

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AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE MATERIAL COMMAND
UNITED STATES AIR FORCE

This Technical Information Memorandum (AFFTC-TIM-08-09, *Compatibility Flight Profile and Internal Environment Characterization for the RASCAL Pod,* Project: Senior RASCAL) was submitted under Job Order Number MT080800 by the Commandant, USAF Test Pilot School, Edwards AFB, California 93524-6485.

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14. ABSTRACT

This report details the limited flight evaluation to certify and characterize the Reconfigurable Airborne Sensor, Communications and Laser (RASCAL) pod on the F-16. The primary objective was to fly an Air Force SEEK EAGLE Office (AFSEO) Compatibility Flight Profile (CFP) in support of flight certification for the RASCAL pod on the F-16. The secondary objectives was to characterize the internal environment of the RASCAL pod in support of various avionics systems in future testing. The RASCAL pod was a modified SUU-20 weapons delivery pod which was designed to carry experimental flight test equipment to support ongoing Test Management Program (TMP) projects sponsored by the USAF Test Pilot School (TPS) and the Air Force Institute of Technology (AFIT). This testing was conducted under TPS Job Order Number MT080800 and was flown 15- 19 September 2008. This flight test program consisted of 7 sorties (7.5 flight hours) conducted in R-2508 and R-2515 airspace. The CFP was completed during the first two sorties, and the 412 Test Wing issued a flight clearance under the recommendation of AFSEO. All internal environment characterization points were completed with specific results geared towards future users located in the body of the report.

15. SUBJECT TERMS

Reconfigurable Airborne Sensor Communications Laser (RASCAL), Pod Air Force Seek Eagle Office (AFSEO), Compatibility Flight Profile (CFP), Flight Testing, Sensors, Lasers, F-16

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Executive Summary

This report details the limited evaluation flight test that was executed to certify and characterize the Reconfigurable Airborne Sensor, Communications and Laser (RASCAL) pod on the F-16. It marked the first time the RASCAL pod was flown on any aircraft. The primary objective of this testing was to fly an Air Force SEEK EAGLE Office (AFSEO) Compatibility Flight Profile (CFP) in support of flight certification for the RASCAL pod on the F-16. The secondary objective was to characterize the internal environment of the RASCAL pod and test the interface between the RASCAL and F-16 in support of the installation of various avionics systems in future testing.

The RASCAL pod was a modified SUU-20 weapons dispenser. RASCAL was designed to carry experimental flight test equipment to support ongoing Test Management Program (TMP) projects sponsored by the USAF Test Pilot School (TPS) and the Air Force Institute of Technology (AFIT). The goal of the RASCAL pod was to allow for short lead time and low cost modifications to a flight test pod to carry various avionics systems and sensors. RASCAL provides the flexibility to incorporate unique scientific instrumentation and data-processing equipment in a transportable pod that can be reconfigured in support of AFIT/TPS projects.

The objective envelope for the RASCAL pod was the current F-16 SUU-20 carriage limit of 7.33 to -2.5 normal symmetric load factors, 5.5 to -1.0 asymmetric load factors, 550 KCAS/Mach 1.2, and 0 to 50,000 feet MSL. The Responsible Test Organization was the 412 Test Wing and testing was executed by the USAF TPS. This testing was conducted under TPS Job Order Number MT080800 and was flown 15 - 19 September 2008. This flight test program consisted of 7 sorties (7.5 flight hours) conducted in R-2508 and R-2515 airspace.

AFSEO issued a recommended flight clearance based upon engineering analysis and contingent upon successful completion of the CFP. The CFP was completed during the first two sorties, resulting in flight clearance for the RASCAL pod. All internal environment characterization points were completed during subsequent sorties, to include vibroacoustic, temperature, pressure and video test points. Specific results for each internal environmental characterization category can be found in the body of the report.

The RASCAL pod supersonic flight clearance on the F-16 could provide a reliable, capable, and low cost platform to efficiently move payloads through a broad range of test conditions. The quantitative characterization of the pod’s interior environmental conditions provides a reliable design specification for future payloads.

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Introduction

This Technical Information Memorandum (TIM) reports on the flight testing that was executed to certify the Reconfigurable Airborne Sensor, Communications and Laser (RASCAL) pod on the F-16. This testing marked the first time the RASCAL pod was flown on any aircraft. The primary objective was to execute an Air Force SEEK EAGLE Office (AFSEO) Compatibility Flight Profile (CFP) in support of an AFSEO flight certification for the RASCAL pod on the F-16. The secondary objective was to characterize the internal environment of the RASCAL pod and test the interface between the RASCAL and F-16 in support of the installation of various avionics systems in future testing. All test objectives were met.

The objective RASCAL envelope was the current F-16 SUU-20 carriage limit of 7.33 to -2.5 symmetric load factor (g), 5.5 to -1.0 asymmetric g, 550 KCAS/Mach 1.2, and 0 to 50,000 ft MSL. The Responsible Test Organization was the 412 Test Wing with execution by the USAF Test Pilot School (TPS). This testing was conducted under TPS Job Order Number MT080800 and was completed between September 15-19, 2008. This flight test program consisted of seven sorties (7.5 flight hours) conducted in R-2508 and R-2515 airspace.

Background

The RASCAL pod was a modified SUU-20 which was designed to carry experimental flight test equipment to support ongoing Test Management Program (TMP) projects sponsored by TPS in conjunction with the Air Force Institute of Technology (AFIT). The goal of the RASCAL pod was to allow for short lead time and low cost modifications to a flight test pod to carry various avionics systems and sensors. RASCAL provided the flexibility to incorporate novel and unique scientific instrumentation and data-processing equipment in a transportable pod that can be reconfigured in support of different AFIT/TPS projects. RASCAL permitted these projects to be completed without making extensive modifications to the test aircraft.

Figure 1: RASCAL Pod Loaded on F-16

Test Item Descriptions

RASCAL Pod

The RASCAL pod, illustrated upside down in Figure 2, was a modified SUU-20 that could be used to carry a variety of avionics systems for future USAF TPS TMPs. The modifications made to the SUU-20 included the removal of the bomb rack ejector assemblies, removal of the rocket launcher tubes and sealing the flare ports. In addition, a Data Acquisition System (DAS), battery and telemetry system were added to the pod.

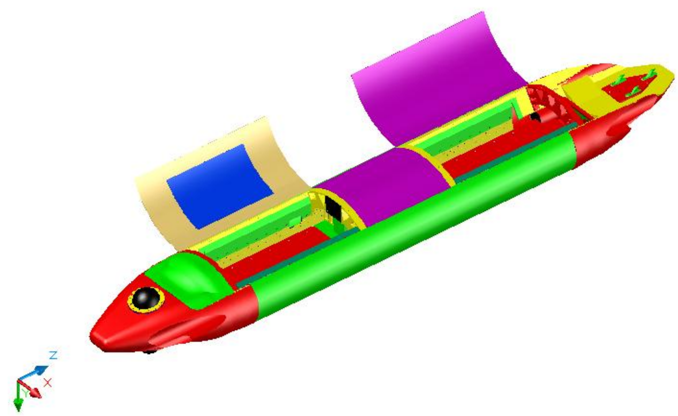

Figure 2: Illustration of the RASCAL Pod with Forward and Aft Bays Open

There were three main sections of the RASCAL pod. The forward section was designed to house up to 60 pounds of experimental equipment. The center section contained sealed batteries and a battery charger to power onboard systems. The aft section housed up to 50 pounds of processor and telemetry equipment. Each section of the pod had a separate access panel. These hinged doors were added on the underside of the pod where the bomb ejectors previously resided. The doors were accessible by support personnel while the pod was hanging under the aircraft, but were secured before flight and could not be opened while in flight. Internally, each section or bay had a “breadboard” style mounting system upon which sensors and other test equipment could be attached.

In the empty configuration, with only batteries installed, the RASCAL pod weighed 356 pounds. In contrast, an unmodified SUU-20 weighed 285 pounds when empty and 468 pounds when fully loaded. The total additional weight of future RASCAL instrumentation and processor equipment installations could not exceed 110 pounds. The addition of 110 pounds of equipment increased the weight of the RASCAL pod to 466 pounds, which is 2 pounds less than the fully loaded SUU-20. The actual weight of the test item that was flown for testing covered by this test plan was 375 lbs. The part number of the RASCAL pod that was used for this testing was 20087113-5. The I_{XX}, I_{YY} and I_{ZZ} moments of inertia of the SUU-20 were within 1 percent of the RASCAL pod for the 20097113-5 configuration. Any configuration change that occurred on future RASCAL test projects required a new dash number and was covered under a different test plan.

RASCAL also contained integral optical ports to allow forward, upward and downward pointing cameras or sensors to survey the environment. GPS antennas were mounted on top of the forward instrumentation bay and telemetry antennas were mounted on the lower deck located just aft of the rear telemetry bay. The interior of RASCAL was not pressurized or temperature controlled. All baseline electrical systems were designed to operate within the F-16 flight envelope. The onboard batteries had provisions to allow continuous recharging from the aircraft bus. However, RASCAL was also capable of running solely on internal power which allowed for ground testing when the pod was disconnected from the aircraft or prior to applying aircraft power.

Aircraft

The F-16 that was used for this testing was a block 30 F-16D (Tail Number 87-00377) modified with a DAS. The F-16 configuration for this testing consisted of two 370 gallon external fuel tanks, captive AIM-120s (air interdiction missiles) on wingtip stations 1 and 9, and the RASCAL pod loaded on station 3. The test configuration is depicted in figure 3 below.

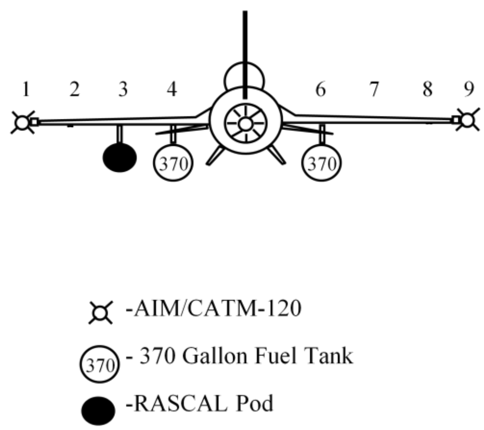

Figure 3: F-16 Configuration for RASCAL CFP and Characterization Flights

The aircraft supplied 115 VAC and 28 VDC to the RASCAL pod in order to charge the internal battery and control the DAS functionality. The pilot had the capability from the cockpit to apply and remove power from the RASCAL as well as activate and deactivate the telemetry (TM) and onboard data recording. The RASCAL pod was controlled from the cockpit using a standard F-16 ALQ-213 Electronic Counter Measures (ECM) panel. Both 28 VDC and 115 VAC power were supplied to the RASCAL when the pilot loaded the RASCAL in the Stores Management System (SMS) as any ECM pod. The pilot could turn on TM and recording by placing the jammer switch to the “ON” position.

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Test and Evaluation

The flight testing covered in this report can be broken into two parts: an AFSEO CFP and a characterization of the RASCAL internal environment for future systems that may be installed in the RASCAL. The CFP was conducted to allow the F-16C/D to fly the RASCAL pod for future test projects. The CFP test configuration, as determined by the AFSEO, was a block 30 F-16 loaded with two 370 gallon external fuel tanks, AIM-120 captive carriage training missiles on wingtip stations 1 and 9, and the RASCAL pod loaded on station 3. The AFSEO Recommended Flight Clearance (RFC) allowed mirror image loadings, but these were not flown during this test program. The internal environment characterization flights measured temperatures, pressure, vibroacoustic levels and optical quality data which were provided to the designers of future experimental equipment that may be carried in the RASCAL pod.

An AFSEO sponsored Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC) checkout was accomplished on 25 July 2008. The EMI/EMC was conducted with the RASCAL pod on a block 30 and 40 F-16 to ensure there was no interference between the RASCAL electrical systems and the F-16 electrical systems. All systems were cleared for EMI/EMC on the ground, with the exception of the instrument landing system (ILS). The ILS was cleared for EMI/EMC on the first flight. No interference or compatibility anomalies were noted.

Compatibility Flight Profile

Two Compatibility Flight Profile (CFP) test flights were conducted under the RFC from the AFSEO. The F-16 flying qualities were not adversely affected by the pod, and no damage to the pod or aircraft was sustained.

The CFP flight test matrix is presented in table 1. AFSEO provided the RFC contained in appendix E based on RASCAL pod pre-flight and post-flight inspections, and the 412th Operations Group approved the RASCAL pod flight clearance. The RASCAL pod flight clearance carriage limits were 7.33 to -2.5 symmetric normal load factors, 5.5 to -1.0 asymmetric load factors, 550 KCAS/Mach 1.2, and 0 to 50,000 feet MSL with the F-16 maneuvering category III set.

Pilot comments related to F-16 flying and handling qualities with the RASCAL pod indicated no objectionable characteristics. The aircraft required some rudder and flaperon trim at all flight conditions due to the asymetric pod loading configuration. RASCAL pod induced vibrations were noticed in the cockpit while transonic at approximately 0.94 Mach at 15,000 and 25,000 feet MSL. Minor low frequency directional oscillations of approximately 1 hertz were encountered at 25,000 feet during wings level sideslips at 0.94M and 1.2M. Increasing load factor generally resulted in decreased pod vibration.

Test Set	Pressure Alt (ft)	Mach	Airspeed (KCAS)	Planned Load Factor	Conditions Achieved	Maneuver
1	15K	0.90	465	5.6	5.6	Wind Up Turn or Symmetric Pull
	15K	0.90	465	4.4	*Ref. set 2*	Positive-G Loaded Roll (Left and Right)
	15K	0.90	465	-2.0	-1.9	Balanced Symmetric Pushover
	15K	0.90	465	-0.8	*Ref. set 2*	Negative-G Loaded Roll (Left and Right)
2	15K	0.90	465	7.0	6.7	Wind Up Turn or Symmetric Pull
	15K	0.90	465	5.5	5.3 / 5.1	Positive-G Loaded Roll (Left and Right)
	15K	0.90	465	-2.5	-2.3	Balanced Symmetric Pushover
	15K	0.90	465	-1.0	-0.8 / -0.7	Negative-G Loaded Roll (Left and Right)
3	25K	1.20	548	7.0	6.8	Wind Up Turn or Symmetric Pull
	25K	1.20	548	5.5	5.5 / 5.2	Positive-G Loaded Roll (Left and Right)
	25K	1.20	548	-2.5	-2.2	Balanced Symmetric Pushover
	25K	1.20	548	-1.0	-0.7 / -0.7	Negative-G Loaded Roll (Left and Right)
4	8K	0.94	550	7.0	7.0	Wind Up Turn or Symmetric Pull
	8K	0.94	550	5.5	5.1 / 5.0	Positive-G Loaded Roll (Left and Right)
	8K	0.94	550	-2.5	-2.0	Balanced Symmetric Pushover
	8K	0.94	550	-1.0	-0.6 / -0.7	Negative-G Loaded Roll (Left and Right)
5	6-6.5K	0.88 - 0.91	530 – 548	N/A	31:24 min	Speed Soak (30 minutes minimum)

Table 1: Compatibility Flight Profile Test Points

Internal Environmental Characterization

Vibroacoustic

A summary of the lateral, vertical, and longitudinal vibroacoustic data from Appendix A is presented in Figures 4, 5 and 6, respectively. The figures show maximum acceleration amplitude observed (units of g root mean squared, RMS) plotted at the Mach number and pressure altitude (PA) conditions where test maneuvers were conducted. Curves of constant KCAS and KEAS airspeeds are provided for reference along with the RASCAL pod flight clearance envelope. The type of symbol at each data point corresponds to the particular type of maneuver conducted when maximum acceleration amplitudes were recorded. Table 2 contains a summary of the dominant frequencies observed in each axis. Reference Appendix A for detailed vibroacoustic data, including time history, RMS history, and power spectral density (PSD) graphs in all three axes for each test maneuver conducted.

Axis	Frequencies (Hz)	Occurrence (%)	Comments and Trends
Vertical	135 - 155	97 %	
Lateral	25 - 35	38 %	
	400 - 480	89 %	
	820 - 840	90 %	Not on takeoff and landing
Longitudinal	135 - 155	92 %	
	600 - 830	22 %	Occurred systematically for Mach ≥ 0.98

Note: Occurrence percentage indicates number of times the frequency range was observed to be dominant out of 87 total flight maneuvers.

Table 2: Summary of Dominant Vibroacoustic Frequencies

Note that the triaxial accelerometer had a ±10g measurement limit, and vibration levels exceeded 10g magnitude during maneuvers with higher sustained normal acceleration. Therefore some of the raw vibroacoustic data was clipped, resulting in a low bias to the reported g RMS values.

Several trends were apparent from the vibroacoustic data presented in these figures. The vertical accelerations at a given condition were consistently greater than the lateral accelerations, which were typically greater than the longitudinal accelerations. In general for any given axis, maximum accelerations increased with increasing airspeed and decreasing altitude. Maximum accelerations in all three axes tended to occur at transonic speeds (0.9M – 0.98M) and lower altitudes (5,000 ft and 15,000 ft).

In the lateral axis (Figure 4), the maximum accelerations occurred during right sideslips at transonic speeds. Note that the RASCAL pod was mounted on station 3 under the left wing, with sideslip causing the flow to be dominated by asymmetric aerodynamic effects between the aircraft and pod. An overall lateral acceleration maximum of 2.4 g RMS occurred while in a transonic right sideslip at 5,000 ft and 0.9M.

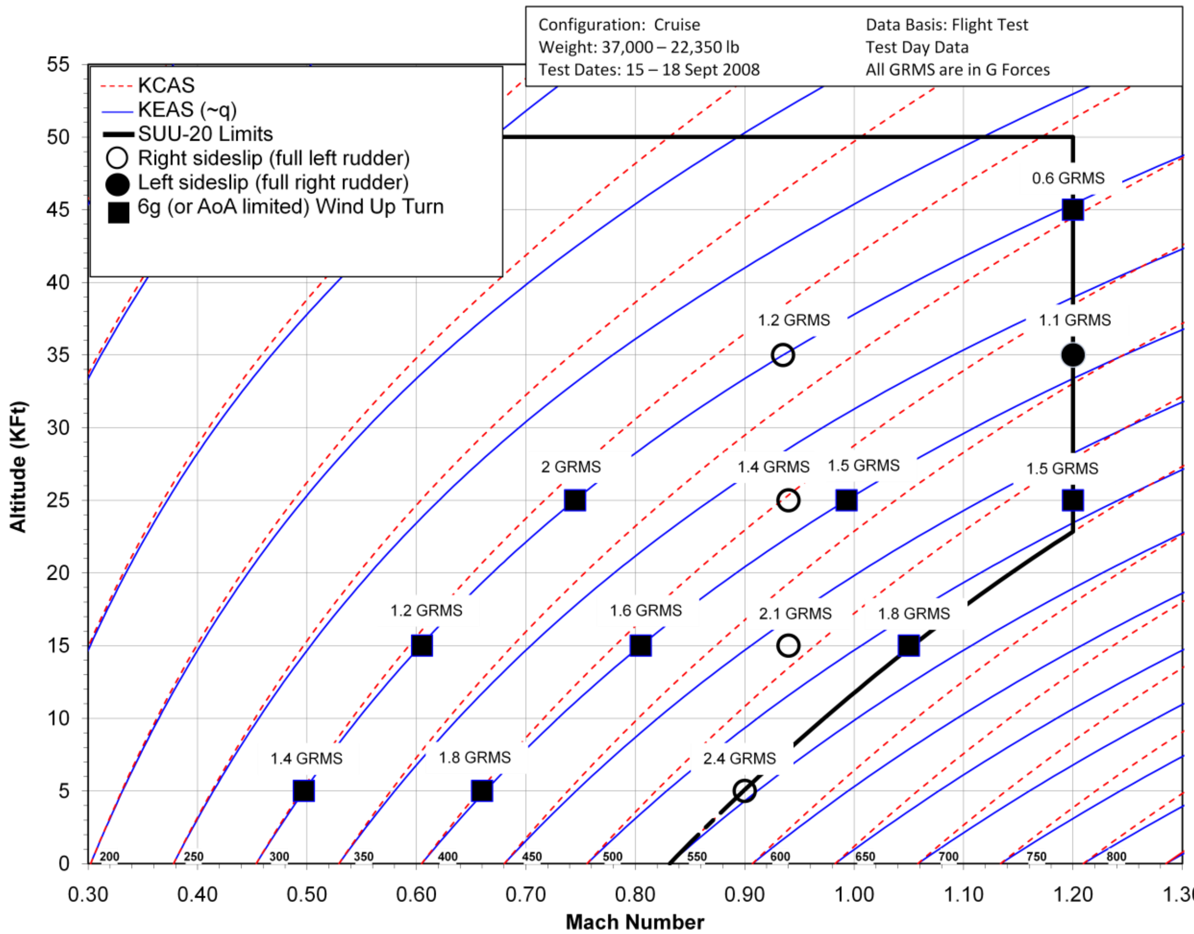

Figure 4: Lateral Axis Vibroacoustics - Maximum RMS Acceleration for each Maneuver Block

In the vertical axis (Figure 5), all maximum accelerations occurred during wind-up turns at elevated load factors. Increasing vertical acceleration was associated with transonic conditions and airflow over the pod at increasing angles of attack. An overall vertical acceleration maximum of 7.5 g RMS occurred while in a transonic wind-up turn at 15,000 ft and 0.94M, corresponding to conditions of maximum pod vibration observed by the flight test aircrew.

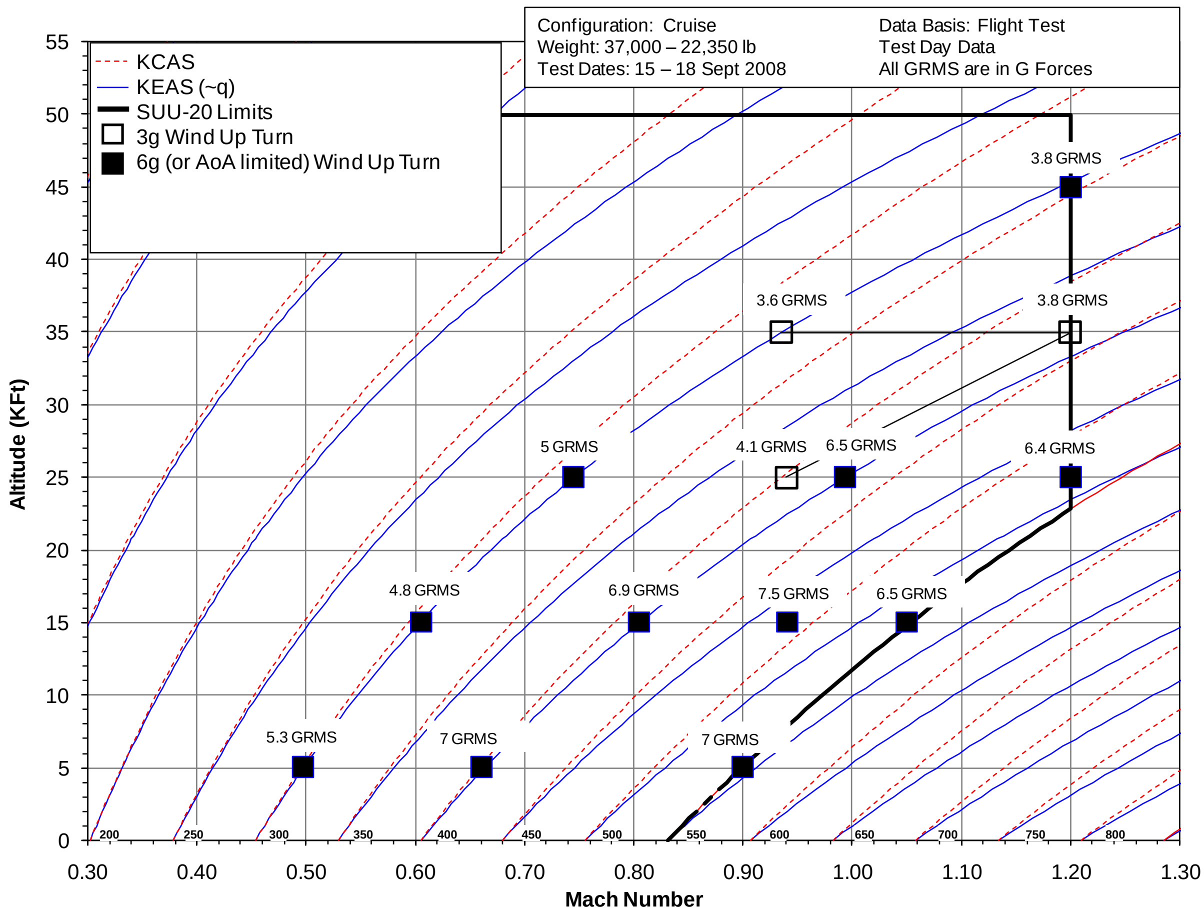

Figure 5: Vertical Axis Vibroacoustics - Maximum RMS Acceleration for each Maneuver Block

In the longitudinal axis (Figure 6), the maximum accelerations occurred during 1g level flight at transonic speeds. An overall longitudinal acceleration maximum of 2.1 g RMS occurred while in transonic 1g flight at 15,000 ft and 0.94M. Note that the 1g level flight longitudinal acceleration data shown was within 0.1 g RMS of the data collected during wind-up turns and sideslips at the same conditions. Therefore the maximum longitudinal accelerations should not be associated with any particular type of maneuver.

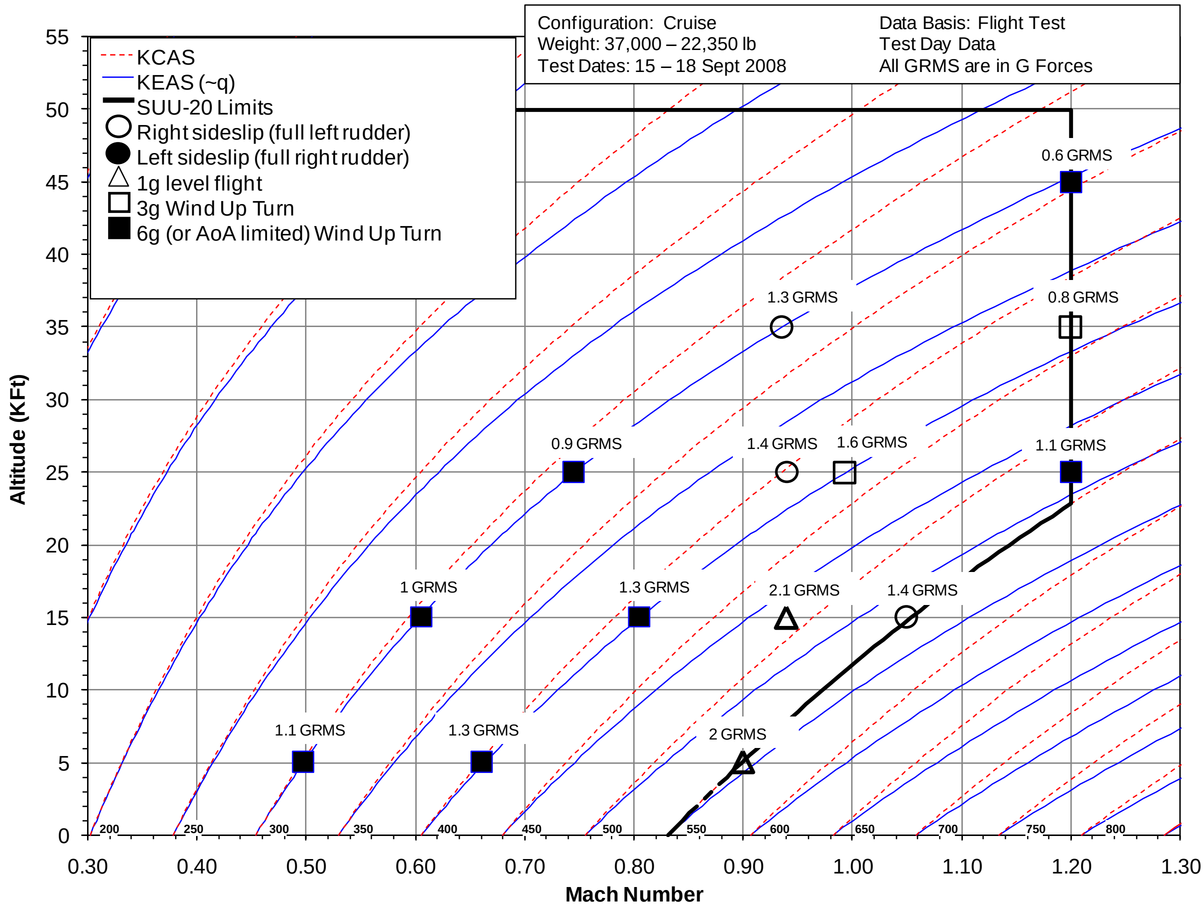

Figure 6: Longitudinal Axis Vibroacoustics - Maximum RMS Acceleration for each Maneuver Block

Video

Video was recorded during a single RASCAL test flight using a camera on a fixed mount in the lower dome. Video data was analyzed for frequency content and qualitatively assessed to determine suitability for future sensor payloads. The flight path was flown at 5,000 feet pressure altitude over two different areas at both 0.6 and 0.75 Mach. These target areas were selected to have significant man-made and high contrast features that would be visually distinct for post-processing and analysis. Figure 7 depicts a sample video frame at 0.75 Mach. The camera was focused at infinity, and was not calibrated for white balance or saturation.

Figure 7: Sample Image of Mojave Airport from RASCAL Camera at 2,245 ft MSL / 0.75M

Four image sequences were analyzed, corresponding to the two targets at both airspeeds. These frames were analyzed for jitter on a frame to frame basis. Figure 8 shows an example of the frame to frame pixel shift during a pass.

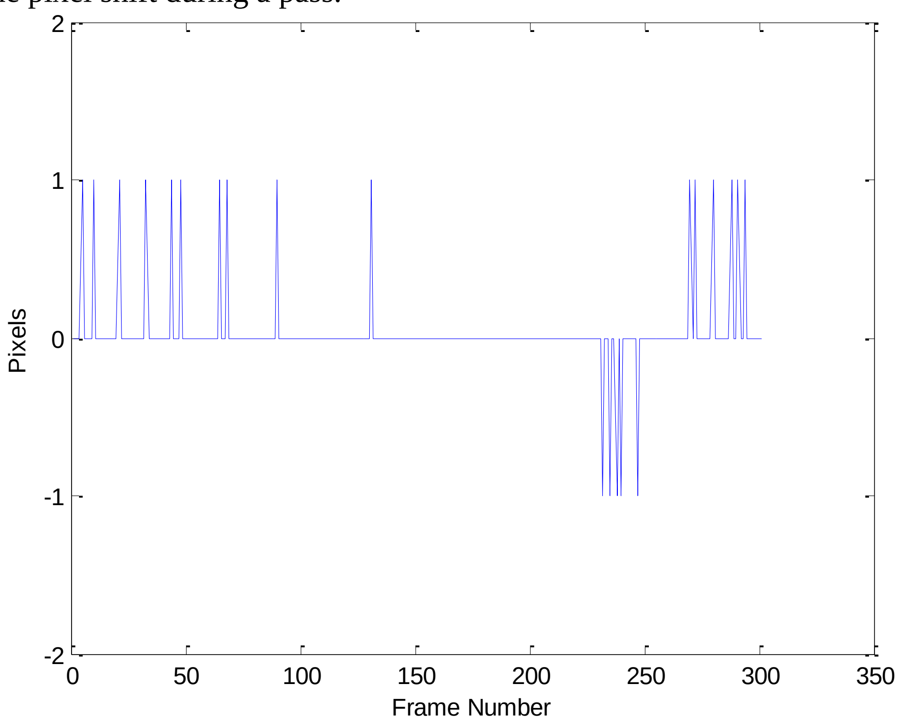

Figure 8: Lateral Pixel Shift at 5000 ft / 0.6M

The resulting jitter power spectral density (PSD) was plotted for both lateral and longitudinal axes on each pass, and showed no dominant frequency spikes for any of the observed conditions. Figure 9 shows the frequency content of the same test point and in the same (lateral) axis. This figure is representative of the data from all test points in both longitudinal and lateral axes, as no dominant frequency is noticeable. This lack of significant frequency content below 15 Hz is consistent with the vibroacoustic trends noted in table 2.

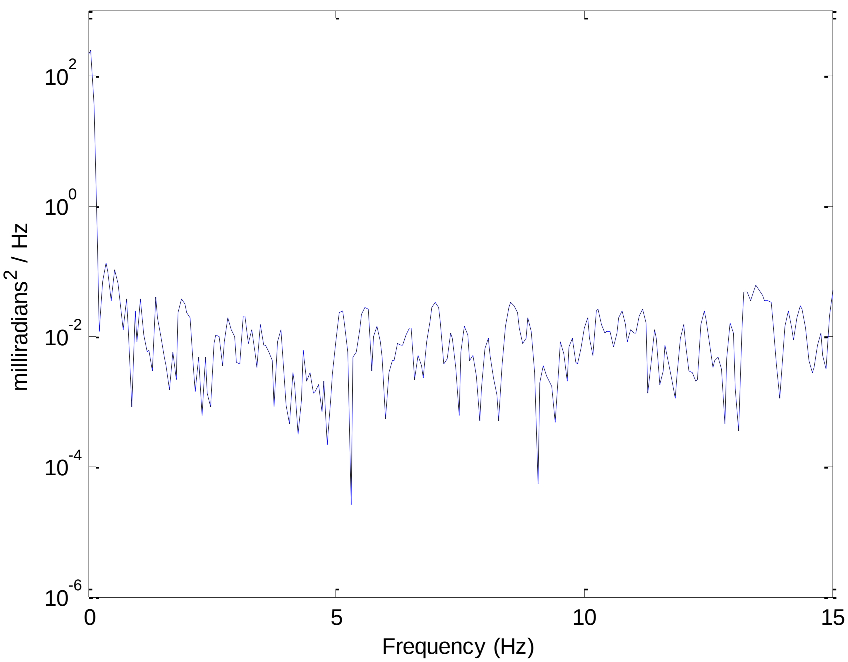

Figure 9: Power Spectral Density of Lateral Image Jitter at 5,000 ft / 0.6M

The root mean squared (RMS) image jitter for each of the passes was as shown in table 3.

Mach / Target	Mojave Airport	California City
0.6	Lateral: 0.1748 mr Longitudinal: 0.3689 mr	Lateral: 0.5033 mr Longitudinal: 0.2264 mr
0.75	Lateral: 0.3912 mr Longitudinal: 0.3562 mr	Lateral: 0.4540 mr Longitudinal: 0.3863 mr

Table 3: Root Mean Squared Video Jitter

As a result of the camera frame rate of 30 frames per second, higher frequency jitter experienced by the camera in the forward dome could not be determined or correlated to RASCAL structural modes as measured in the aft compartment. Qualitative review of the video showed easily recognizable imagery and good quality video. The test team concluded that RASCAL was suitable as a video sensor platform.

Pressure

Data collected from the forward compartment pressure transducer were used to determine the pressure differential between internal RASCAL pod pressure and external (ambient) static

pressure. The external pressure was calculated by multiplying the F-16 mux bus pressure ratio by the standard day sea level static pressure. The test techniques used to evaluate this pressure differential was the penetration descent because this maneuver exhibited the maximum rate and magnitude of ambient pressure change. Figure 11 shows the pressure difference between the RASCAL forward compartment and ambient pressure during the penetration descent. The penetration descent was executed after the RASCAL pod internal pressure was stabilized at 2.0 psi at 45,000 ft MSL. As the plot shows, there was initially a 0.5 psi difference between the RASCAL internal pressure and ambient pressure, but the difference decreased to 0.1 psi after approximately 100 seconds and stabilized for the remainder of the descent. This demonstration showed that even for a high rate of pressure change, the RASCAL internal pressure closely tracked the ambient pressure. This result was expected since the RASCAL pod internal environment was not sealed from the atmosphere.

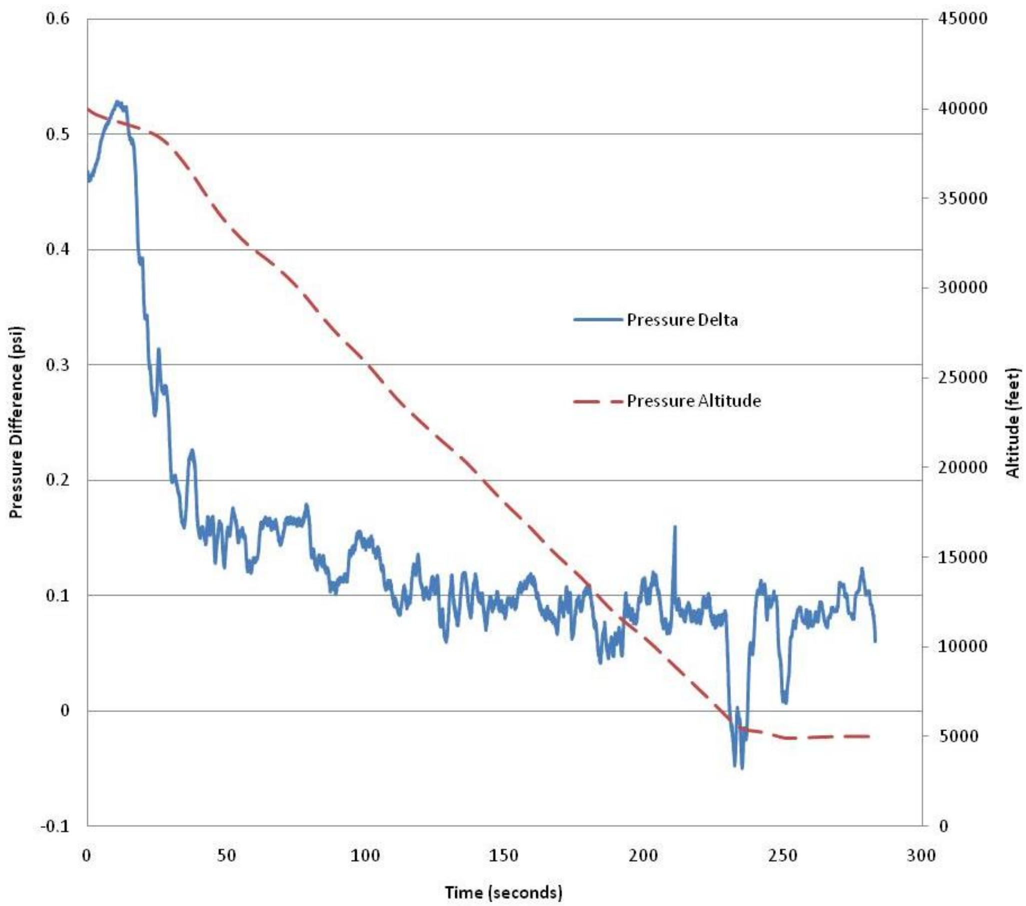

Figure 10: Pressure Difference Between RASCAL Internal and Ambient Pressure during Penetration Descent

Temperature

Temperature was measured and evaluated for level accelerations from 250 KCAS to the maximum level flight airspeed for five different pressure altitudes (5,000, 15,000, 25,000, 35,000, and 45,000 feet). The maximum flight envelope temperature was evaluated by conducting a hot soak at 500 ft PA for twenty minutes over Death Valley. The minimum flight

envelope temperature was evaluated by conducting a cold soak at 50,000 ft PA for twenty minutes. The overall trends for all of the temperature test points were as follows. The forward compartment temperature quickly responded to changes in outside air temperature (OAT) and total temperature during level accelerations and the cold and hot soaks. The central and aft compartments responded much slower to changing total temperature and outside air temperature. Details on the rates of temperature change can be found in appendix D. The maximum temperature observed was 73 degrees Celsius in the forward compartment during the hot soak. The minimum temperature observed was -36 degrees Celsius in the forward compartment during the cold soak. During both the hot and cold soaks, the central and aft compartments were approaching the forward compartment temperature, but did not stabilize during the twenty minute maneuver. Figure 10 summarizes the maximum and minimum RASCAL Pod compartment temperatures, and outside air temperatures observed for the temperature test points flown.

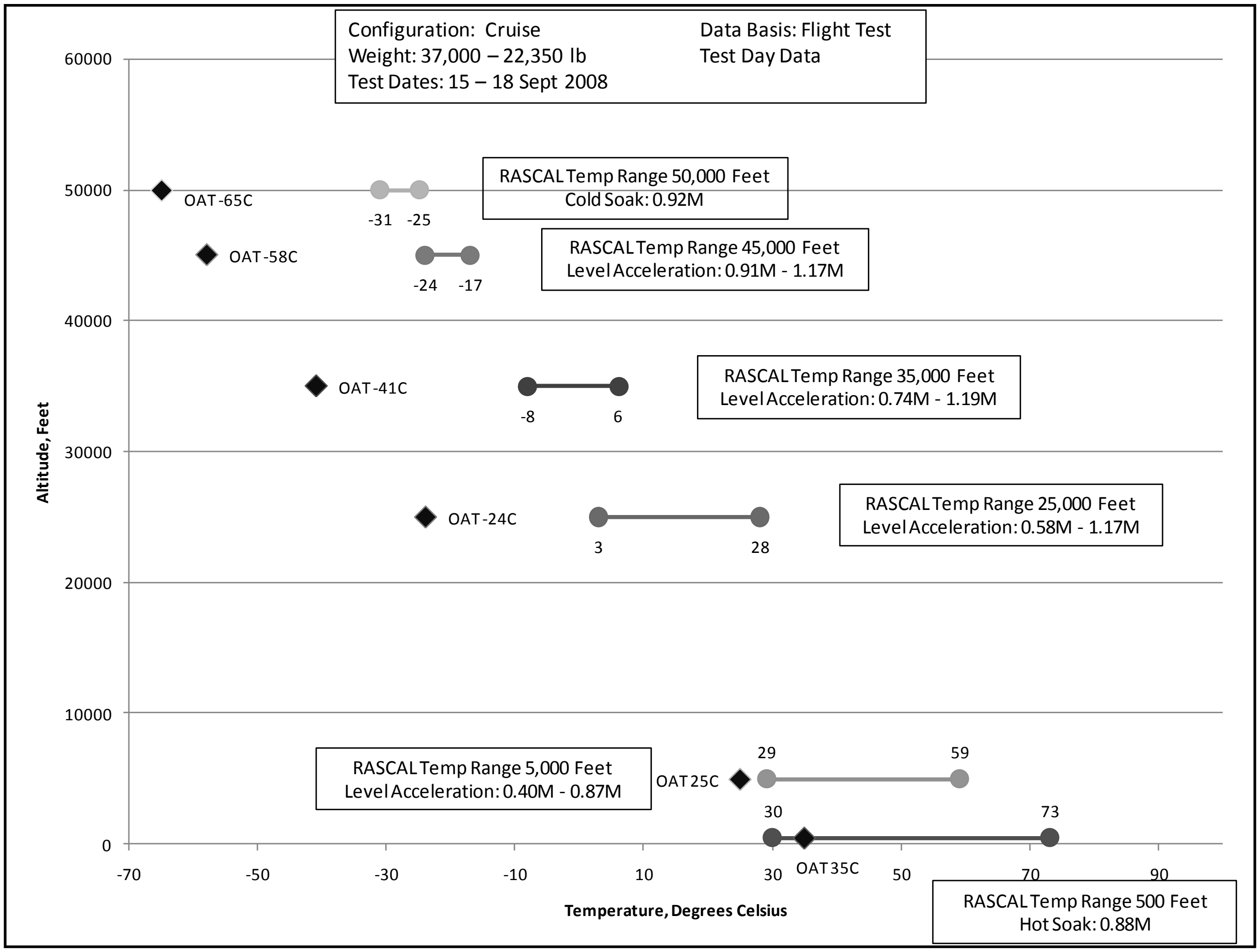

Figure 11: RASCAL Pod Temperature Test Point Summary

Conclusions

This limited evaluation to certify and characterize the Reconfigurable Airborne Sensor, Communications and Laser (RASCAL) pod on the F-16 met all test objectives. Flight certification for the RASCAL pod on the F-16 was accomplished via completion of an Air Force SEEK EAGLE Office (AFSEO) Compatibility Flight Profile (CFP). All internal environment characterization points were completed, including vibroacoustic, temperature, pressure and video test points.

The RASCAL pod flight clearance on the F-16 provides a reliable, capable, and low cost platform to efficiently move payloads through a broad range of test conditions. The RASCAL pod flight clearance carriage limits were 7.33 to -2.5 symmetric normal load factors, 5.5 to -1.0 asymmetric load factors, 550 KCAS/Mach 1.2, and 0 to 50,000 feet MSL.

Quantitative characterization of the pod's internal environmental conditions provides a reliable design specification for future payloads. The RASCAL internal vibroacoustic environment was generally proportional to dynamic pressure, and the greatest magnitude vibrations were consistently along the vertical axis. Maximum accelerations tended to occur at transonic speeds and lower altitudes. The acceleration data is biased low due to signal clipping caused by accelerometers limited to ±10g. The forward compartment temperature responded quickly to increased outside air temperature and total temperature. The central and aft compartments responded much slower to changing total temperature and outside air temperature. RASCAL internal pressure closely tracked the ambient outside air pressure. RASCAL camera data had low quantitative levels of image jitter, and qualitatively showed easily recognizable imagery and good quality video.

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6. MIL-HDBK-1763. Aircraft Stores Compatibility: System Engineering Data

Appendix A – Vibroacoustic Data

This appendix contains plots of the vibroacoustic data collected from the triaxial accelerometer via telemetry and onboard recording. Figure A1 illustrates the location of the accelerometers within the RASCAL pod. The triaxial accelerometer was limited to measurements of ±10g, and clipped signals exceeding this magnitude. This caused the g RMS data presented to be biased low for the associated tests when accelerations greater than 10 g magnitude occurred.

Because of the accelerometer mount configuration, the signal for the vertical acceleration has an inverted sign convention relative to aircraft acceleration data. On the following plots, the solid blue line represents the RASCAL pod vertical acceleration while the solid black line represents the aircraft vertical acceleration. Some acceleration plots present isolated spikes in the data. It was determined that those spikes were not due to telemetry dropouts, as the pod onboard DAS recording matches the telemetered data.

The RASCAL forward compartment was also instrumented with a microphone to collect sound pressure level data. Although the sensor functioned, the data was not recorded in a valid format and was unassessable.

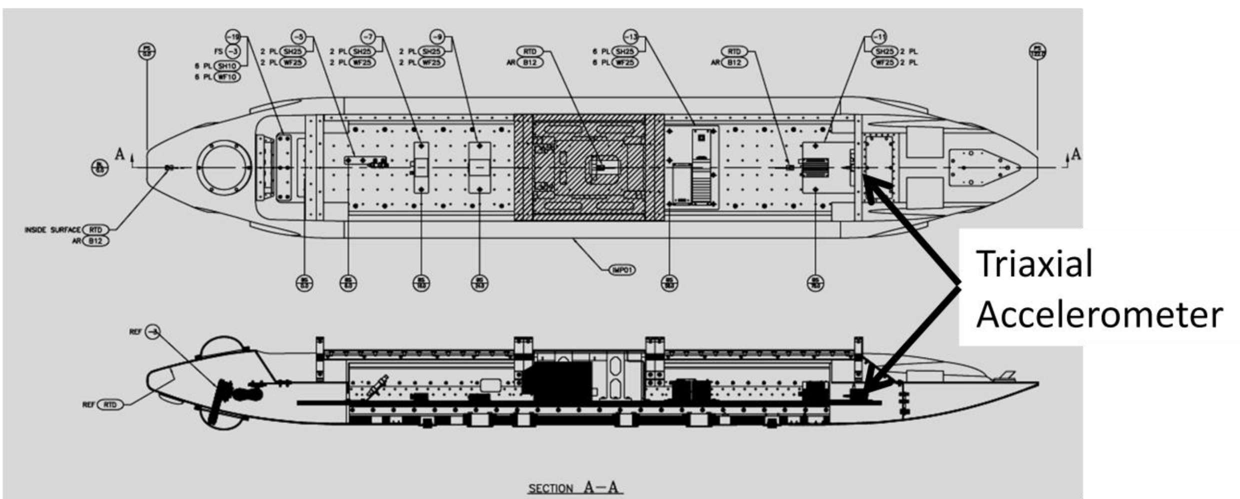


Figure A12: Triaxial Accelerometer Location

Vibroacoustic data measurements were recorded during takeoffs, landings, level accelerations, and specific maneuver blocks of varying sideslip, load factor, and angle of attack (AOA). The flight conditions corresponding to the data plots in this appendix are presented in figure A2. This figure is a plot of Mach number versus altitude with curves of constant calibrated and equivalent airspeed. The equivalent airspeed curves correspond to curves of constant dynamic pressure. The RASCAL pod flight envelope is shown for reference, corresponding to the received AFSEO clearance. Takeoff and landing conditions are not included in figure A2, but occurred at field elevation (2300 feet MSL) and approximate speed from static to 160 KCAS (~0.25M). Each airborne vibroacoustic data point depicted in figure A2 consisted of wings level

sideslips and stabilized load factor conditions. Data bands and tolerances for these tests are summarized in table A1.

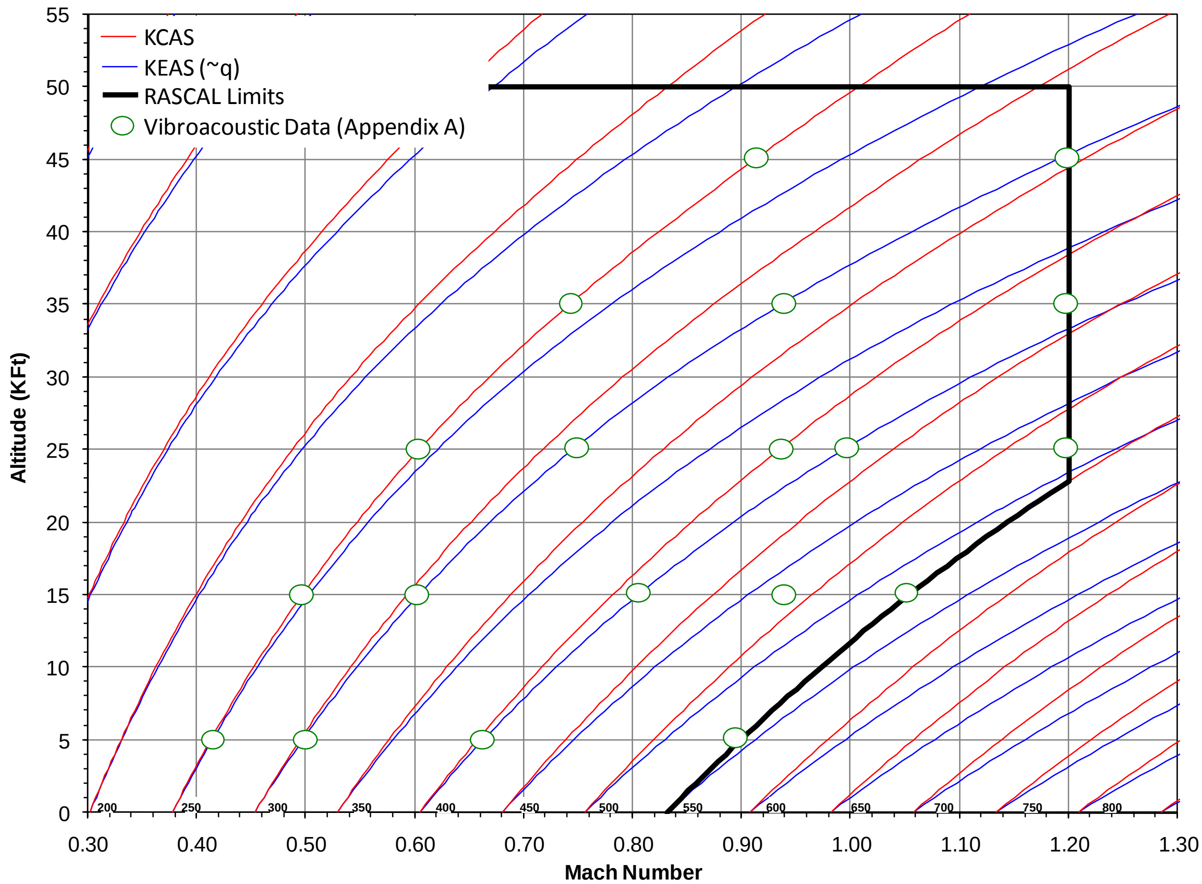


Figure A213: Flight conditions for Appendix A vibroacoustic data plots.

Parameter	Data Band	Tolerance	Limits
Airspeed (kts)	±10	±10	550 KCAS maximum
Mach number	±0.03	±0.03	1.2M maximum
Altitude (ft)	±1,000	±1,000	500ft AGL minimum, 50,000ft MSL maximum
Load factor (g)	±0.3	±0.3	-2.5g minimum symmetric, +7.0g maximum symmetric, ≤0g 10s maximum
Angle of Attack (deg)	±1	±1	16

Table A1: Data Bands and Tolerances for the Vibroacoustic Tests

Table A2 summarizes the conditions for all of the vibroacoustic data plots presented in appendix A. The flight manual static takeoffs were conducted at military and maximum power. The flight manual landings were from straight-in and overhead patterns with touch-and-go and full stop landings. The sideslip conditions were executed with ramped left (positive sideslip) and right (negative sideslip) rudder pedal inputs from a stabilized 1g trim shot. The 1g test conditions

corresponded to straight and level flight, and the 0g conditions were obtained by a symmetric push-over from a wings level initial condition. Load factors greater than 1g were obtained by executing stabilized load factor turns, or maximum Category III (CAT III) angle of attack of 16 degrees if that occurred first as aft stick pressure was increased.

Altitude (ft MSL)	**Airspeed / Mach**	**Load Factors (g)**	**Sideslip (deg)**	**Notes**
2,300	0 – 160 KCAS	1	0	Takeoffs, landings
5,000	250 KCAS	1	0	
	300 KEAS	0, 1, 2.9, 4.5(16°AOA)	-7.5 ; +7.5	
	400 KEAS	0, 1, 3.2, 6	-6.3 ; 4.8	
	550 KCAS	0.3, 1, 3.2, 6	-4.7 ; +4	
15,000	250 KCAS	1	0	
	300 KEAS	1, 3, 6	-9.5 ; +7.5	
	400 KEAS	0, 1, 3, 5.7	-8 ; +5.4	
	0.94M	0, 1, 3, 6	-5.2 ; +4.8	Aircrew observed max pod vibration
	550 KCAS	0, 1, 3, 6	-3.4 : +3	
25,000	250 KCAS	1	0	
	300 KEAS	0, 1, 2.9, 4.3(16°AOA)	-8.5 ; +7.7	
	0.94M	1, 2.4	-4.2 ; +3.5	Aircrew observed max pod vibration
	400 KEAS	0, 1, 3, 6	-6.1 ; +5.2	
	1.2M	0, 1, 3, 6	+2.8	
35,000	250 KCAS	1	0	
	300 KEAS	0, 1, 3.1(16°AOA)	+6	
	1.2M	0, 1, 3	-4.4 ; +3.2	
45,000	250 KCAS	1	0	
	1.2M	0, 1, 3, 3.5(15°AOA)	-4 ; +2.5	

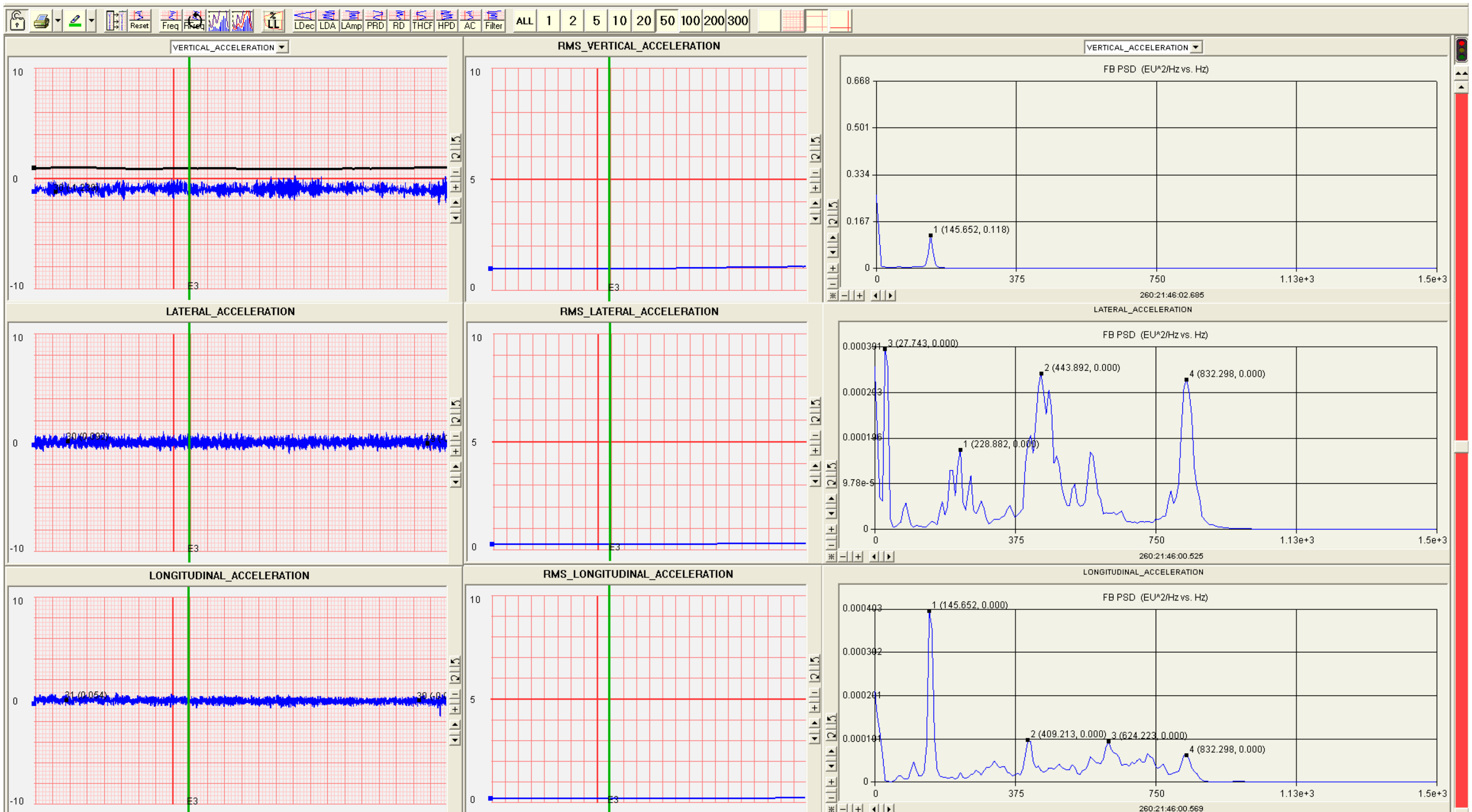
Notes: Load factor data at 0° sideslip, and sideslip data at 1g. Positive sideslip due to left rudder, negative sideslip due to right rudder.

Table A2: Flight Conditions for Appendix A Vibroacoustic Data Plots

Each plot in Appendix A is a screen capture from the IADS software program of nine graphs organized into three columns and three rows. The leftmost column of graphs are the raw acceleration data in units of g recorded at 7.1 kHz versus time in seconds. The center column of graphs are the root mean squares (2 second window) of the acceleration data in units of RMS g versus time in seconds. The right column of graphs are the power spectral density (PSD) of the acceleration data in units of [G^2/Hz] versus frequency [Hz]. The PSDs were calculated with a Hanning windowing, block size of 1024 samples, and 50 percent overlap. The top row of graphs represent data from the vertical axis, the middle row from the lateral axis, and the bottom row from the longitudinal axis.

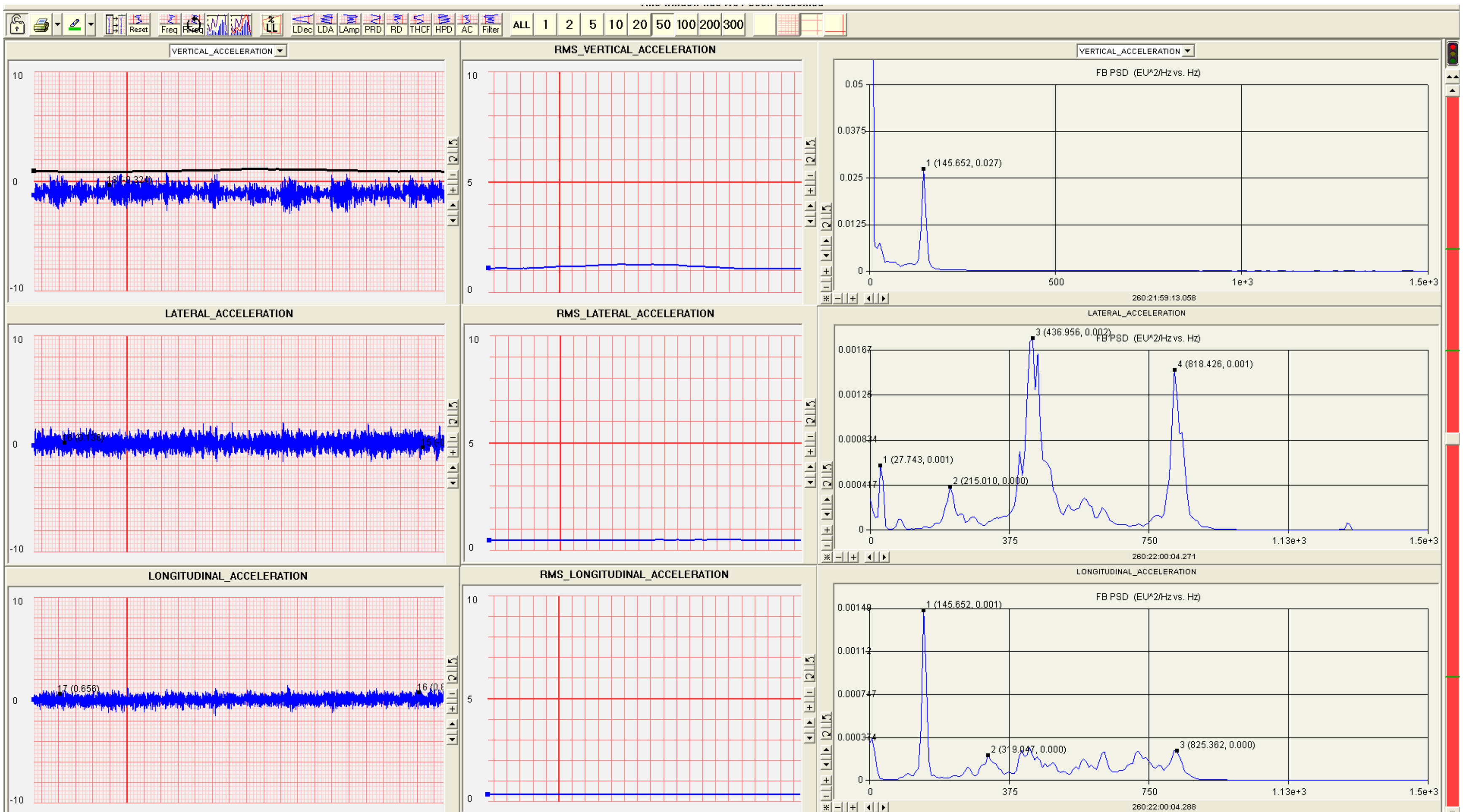
On each screen capture all of the time history graphs (6 in total) are plotted using the same time scale. The time scale is determined by the button clicked at the top of the RMS vertical acceleration graph.

Figure A3: 5K, 250 KCAS, 1g



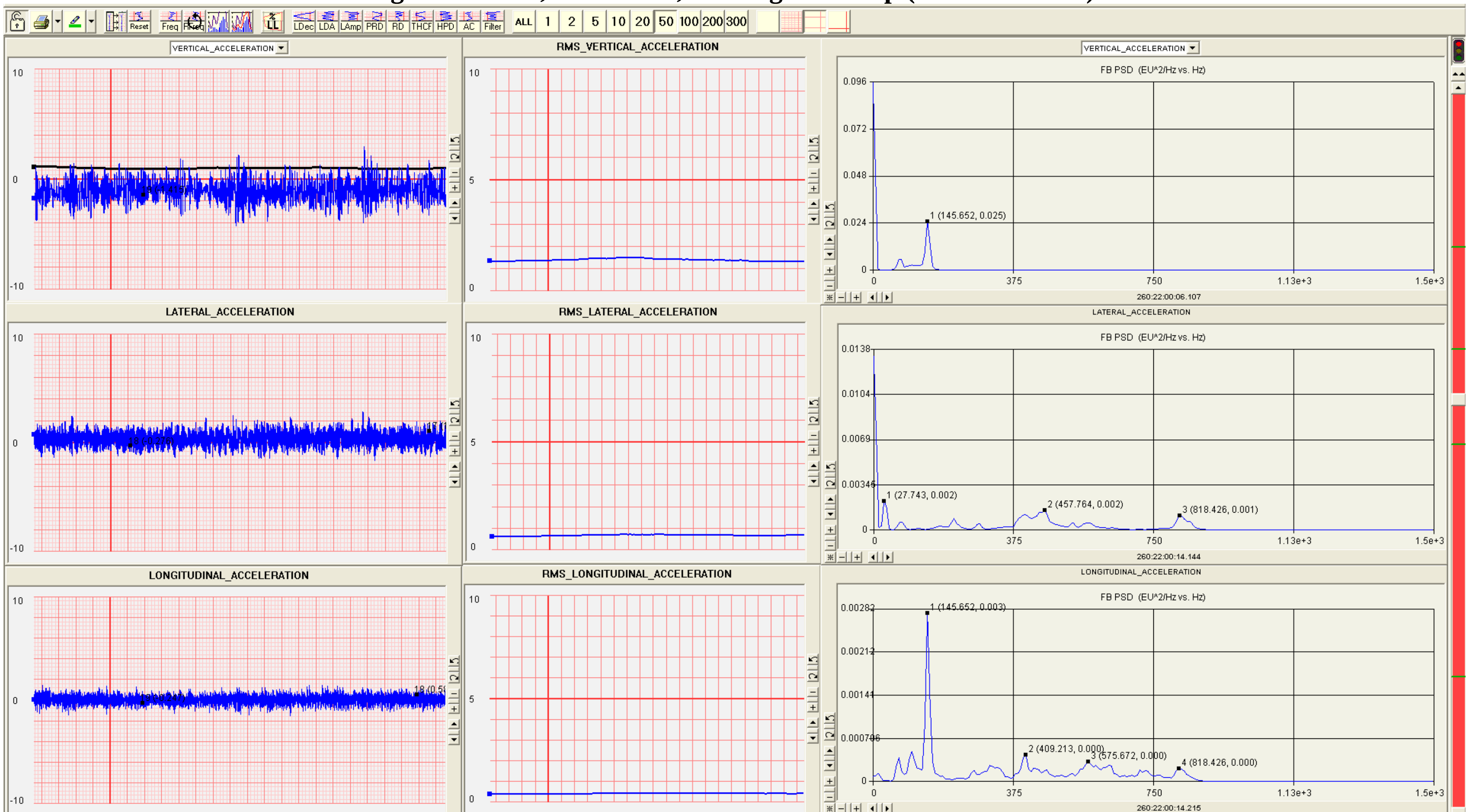
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A4: 5K, 305 KCAS, 1g



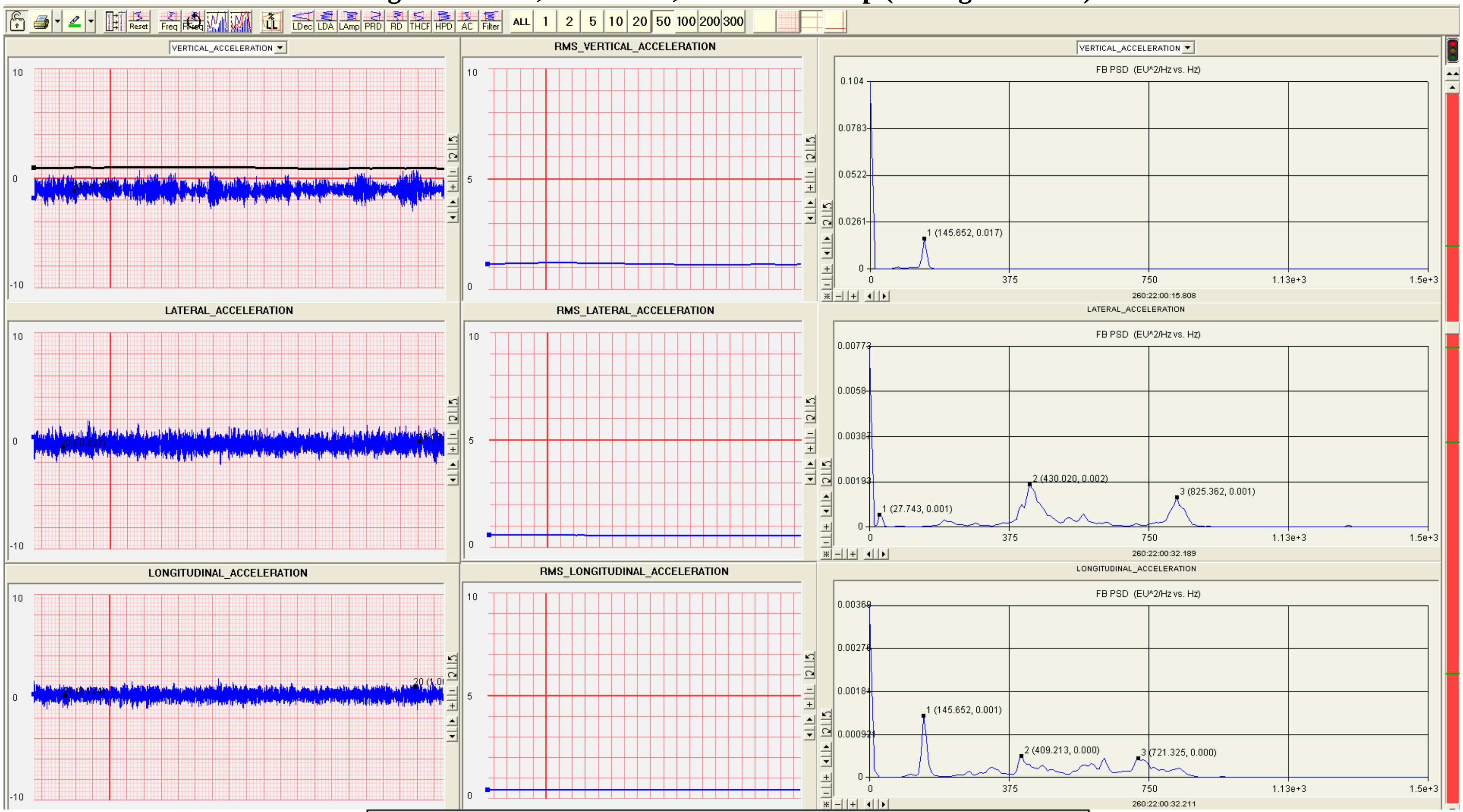
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A5: 5K, 305 KCAS, 7.5° Right sideslip (full left rudder)



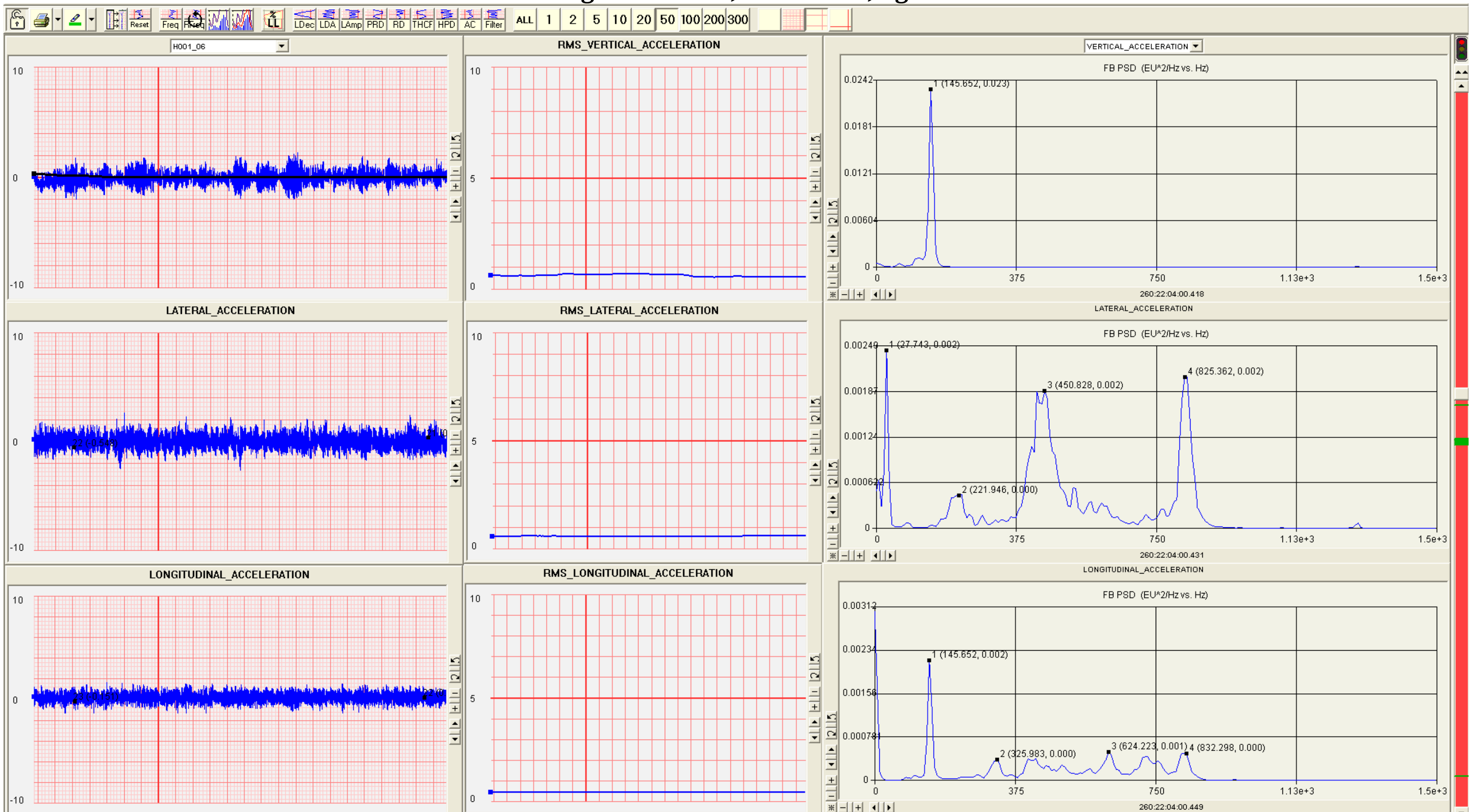
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A6: 5K, 305 KCAS, 7.5° Left sideslip (full right rudder)



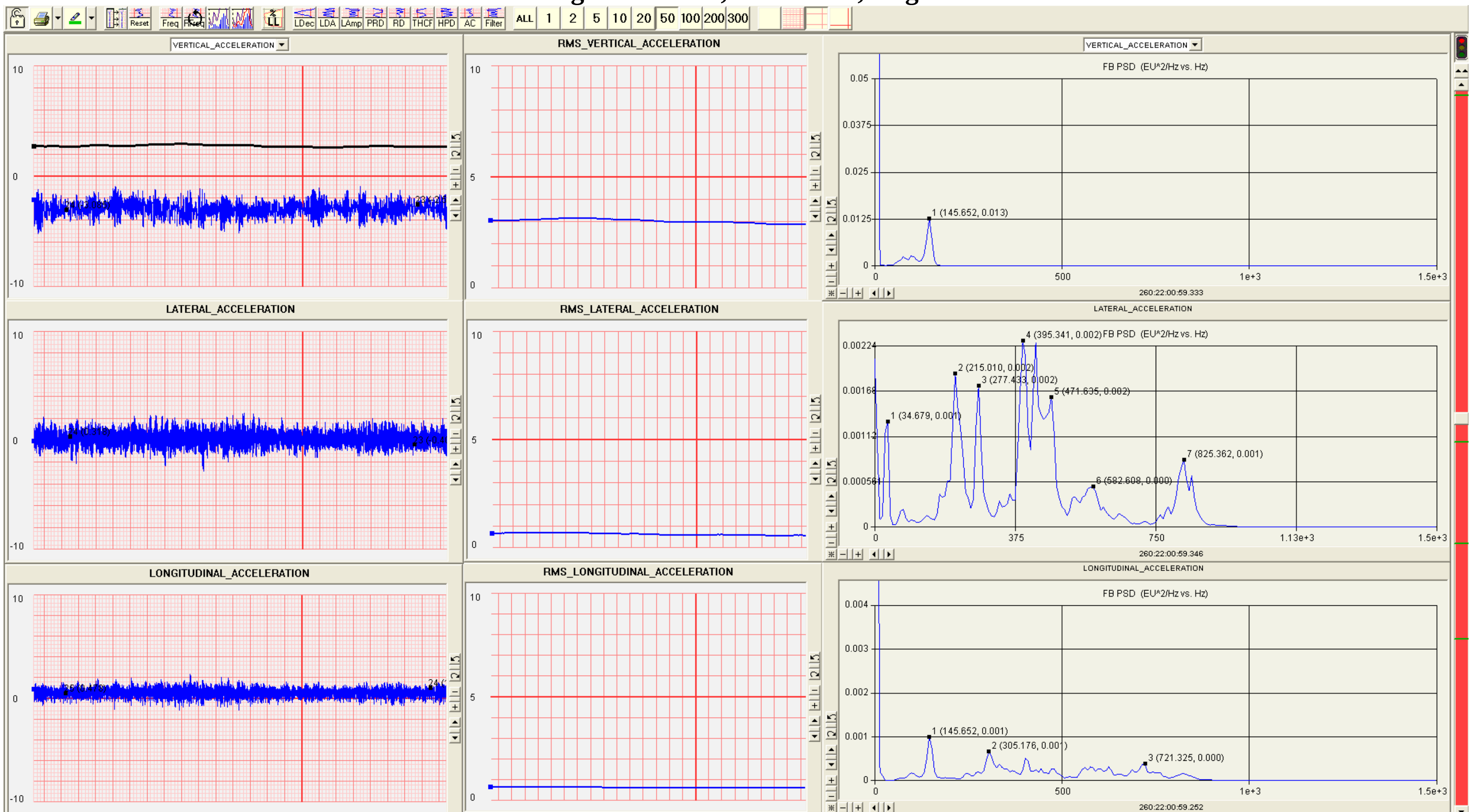
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A7: 5K, 305 KCAS, 0g



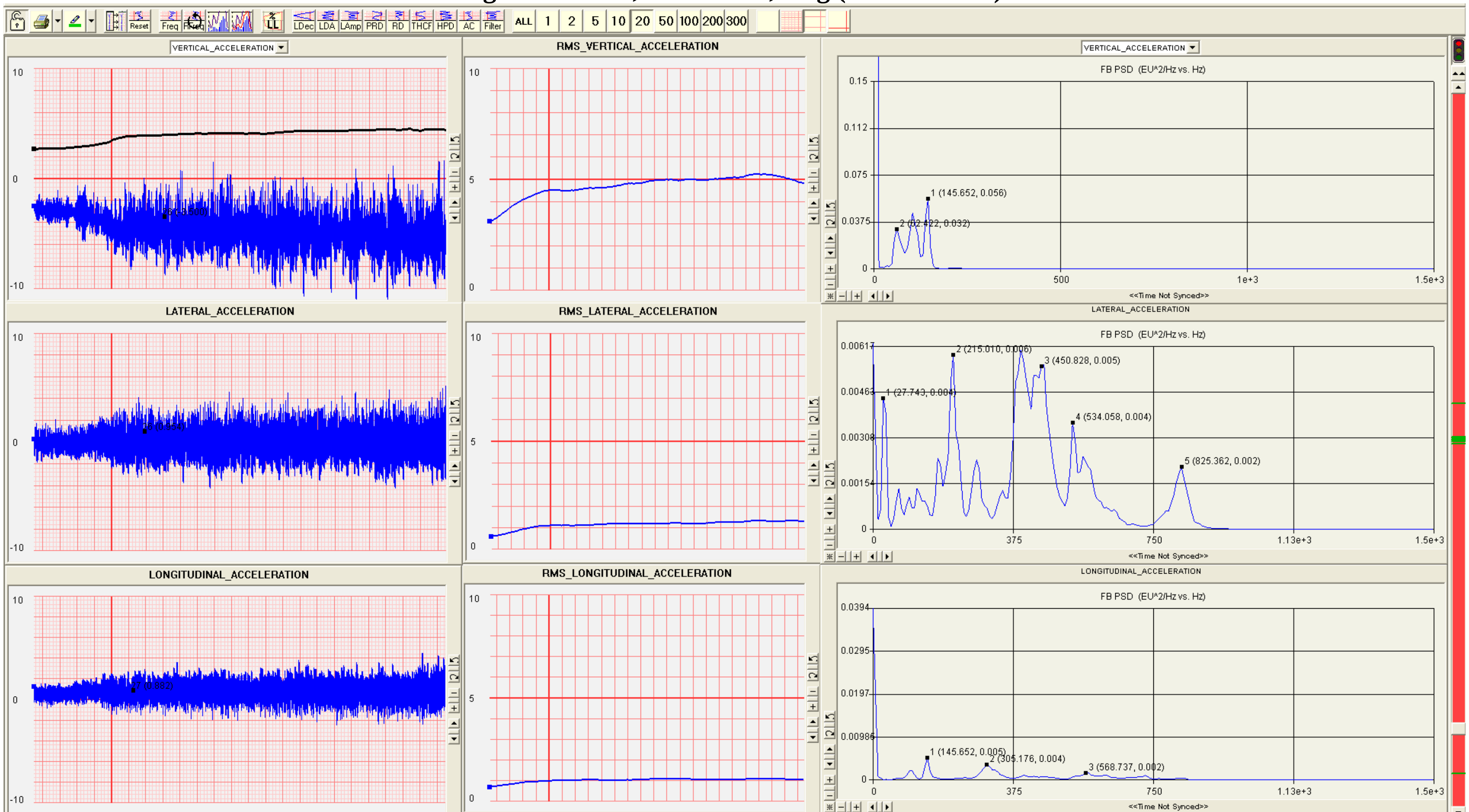
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A8: 5K, 305 KCAS, 2.9g



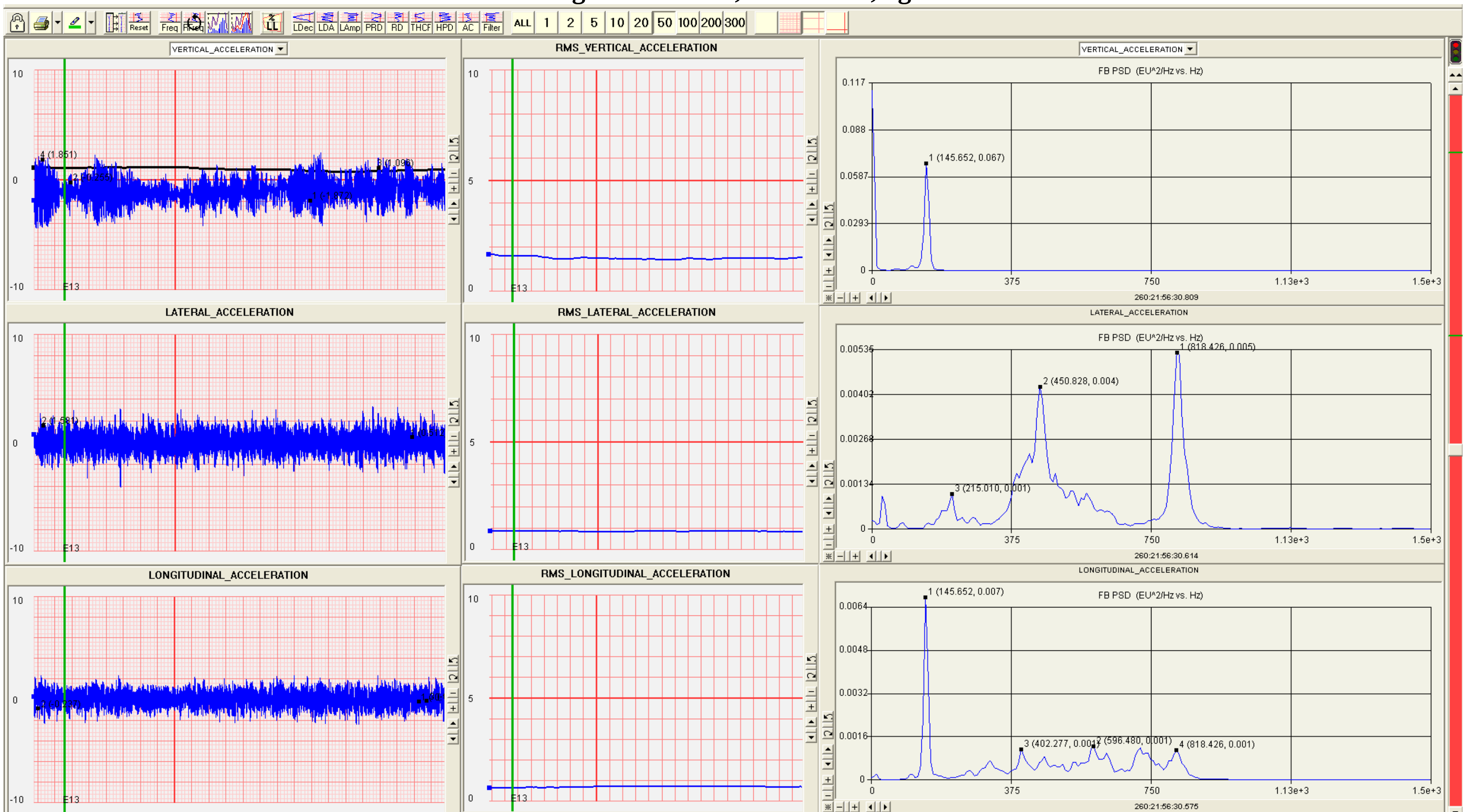
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A9: 5K, 305 KCAS, 4.5g (AOA limited)



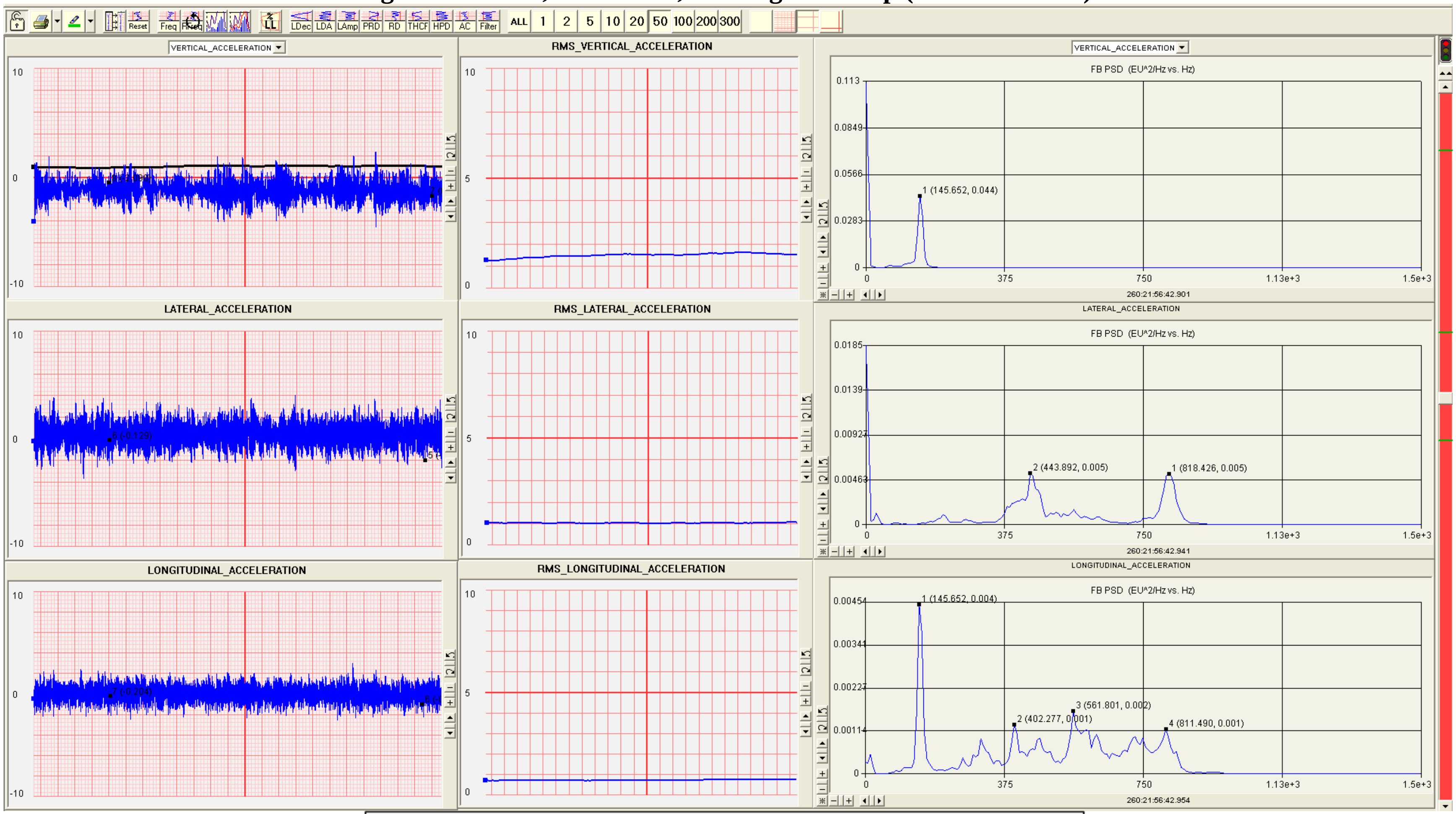
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A10: 5K, 403 KCAS, 1g



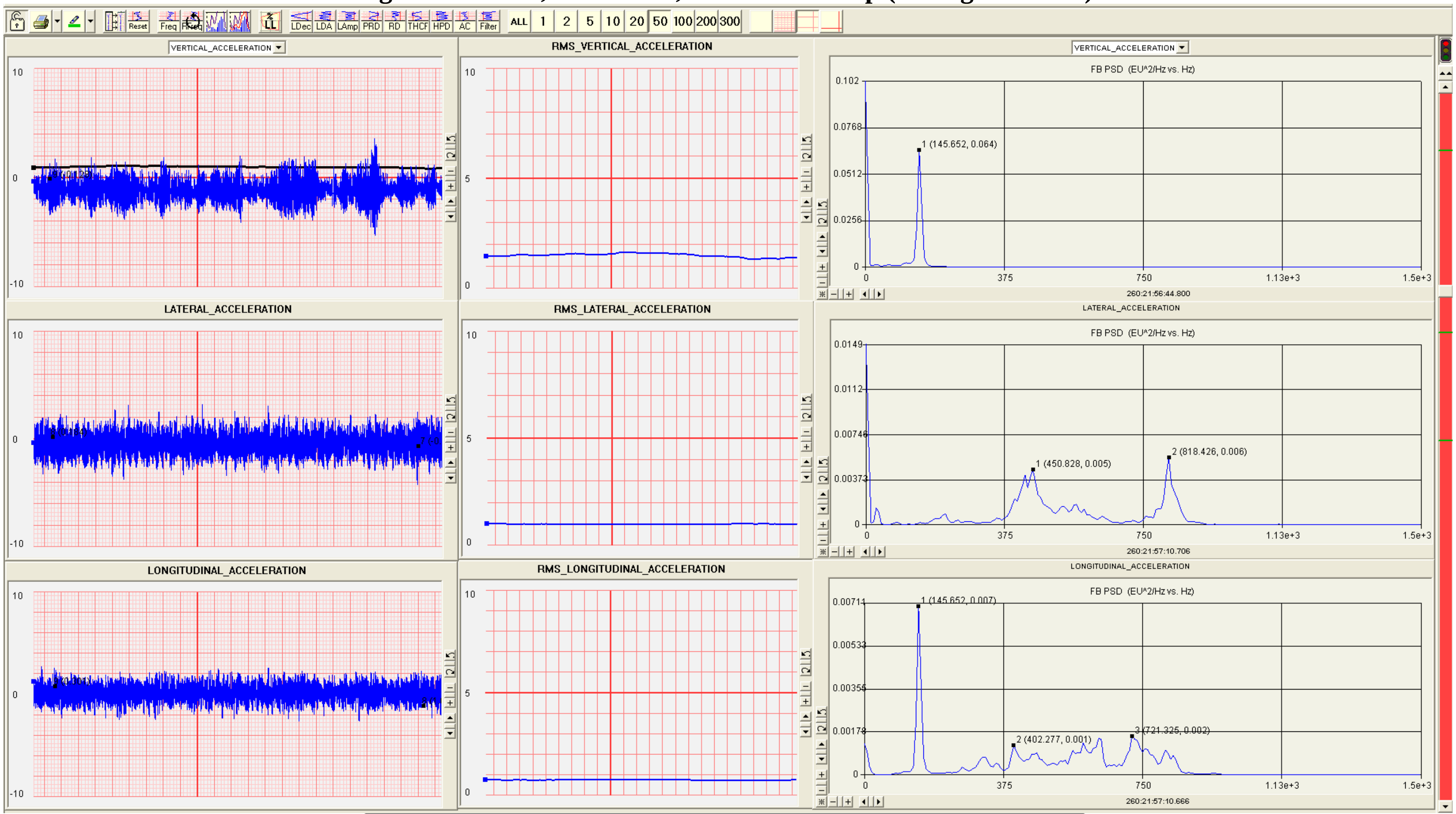
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A11: 5K, 403 KCAS, 4.8° Right sideslip (full left rudder)



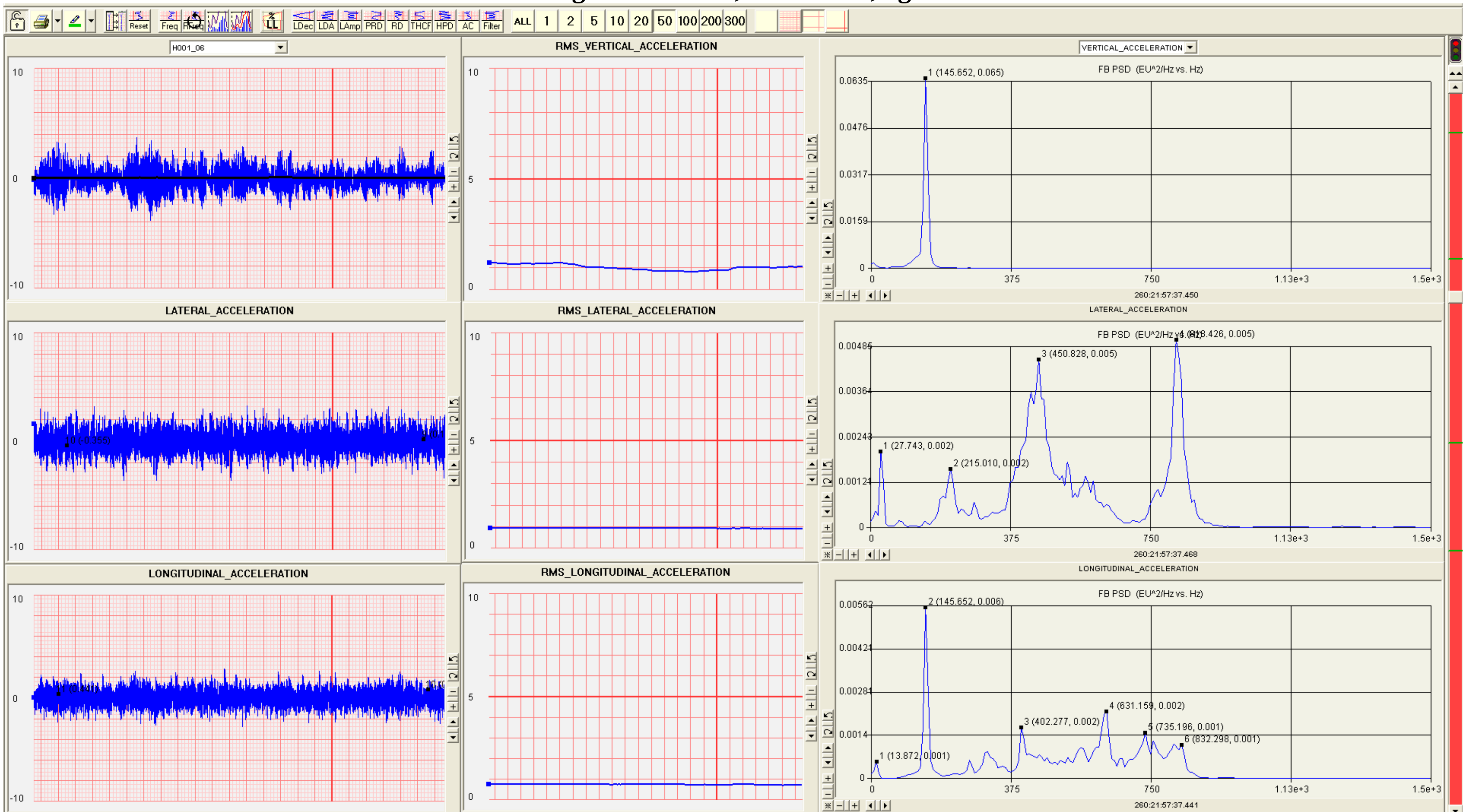
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A12: 5K, 403 KCAS, 6.3° Left sideslip (full right rudder)



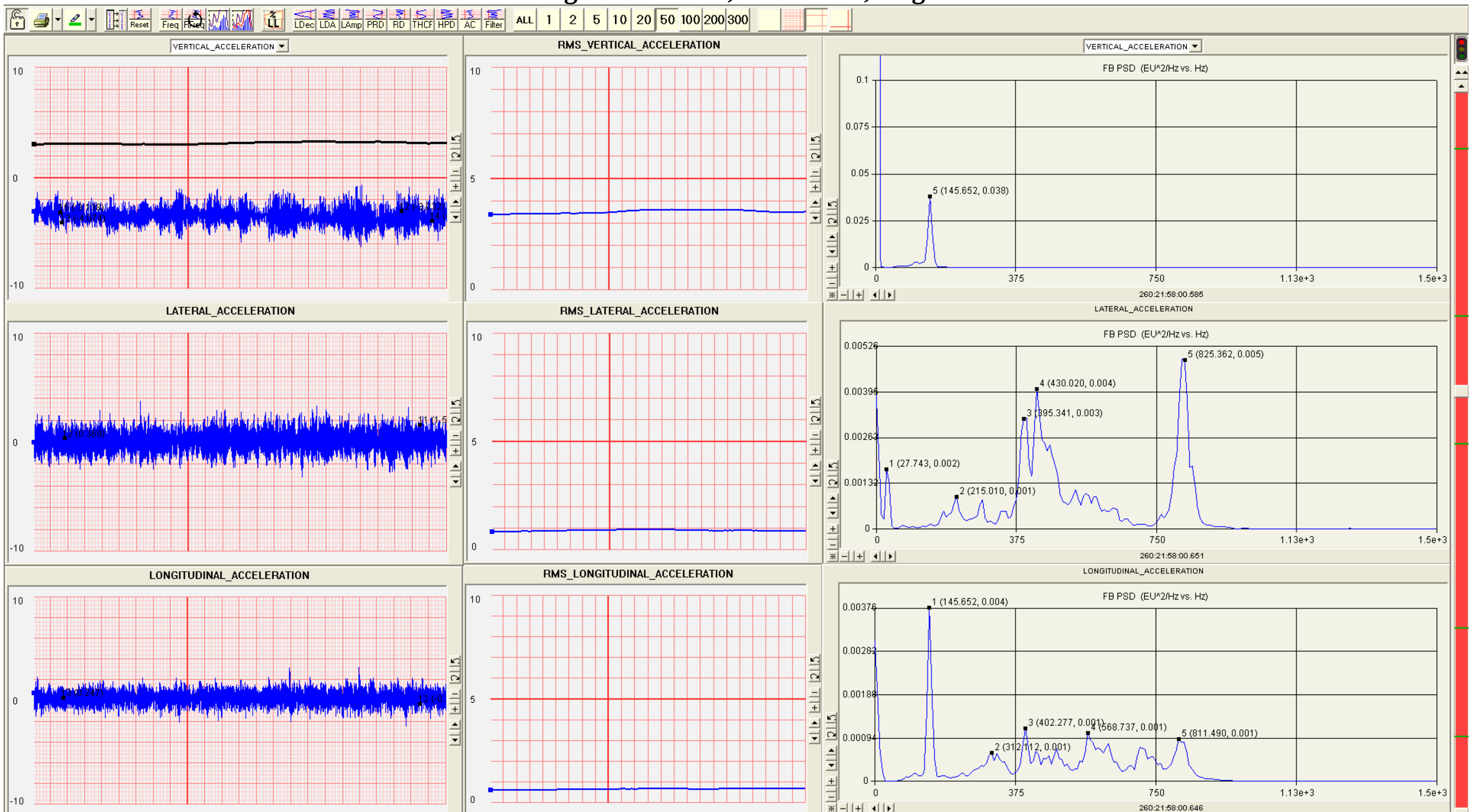
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A13: 5K, 403 KCAS, 0g



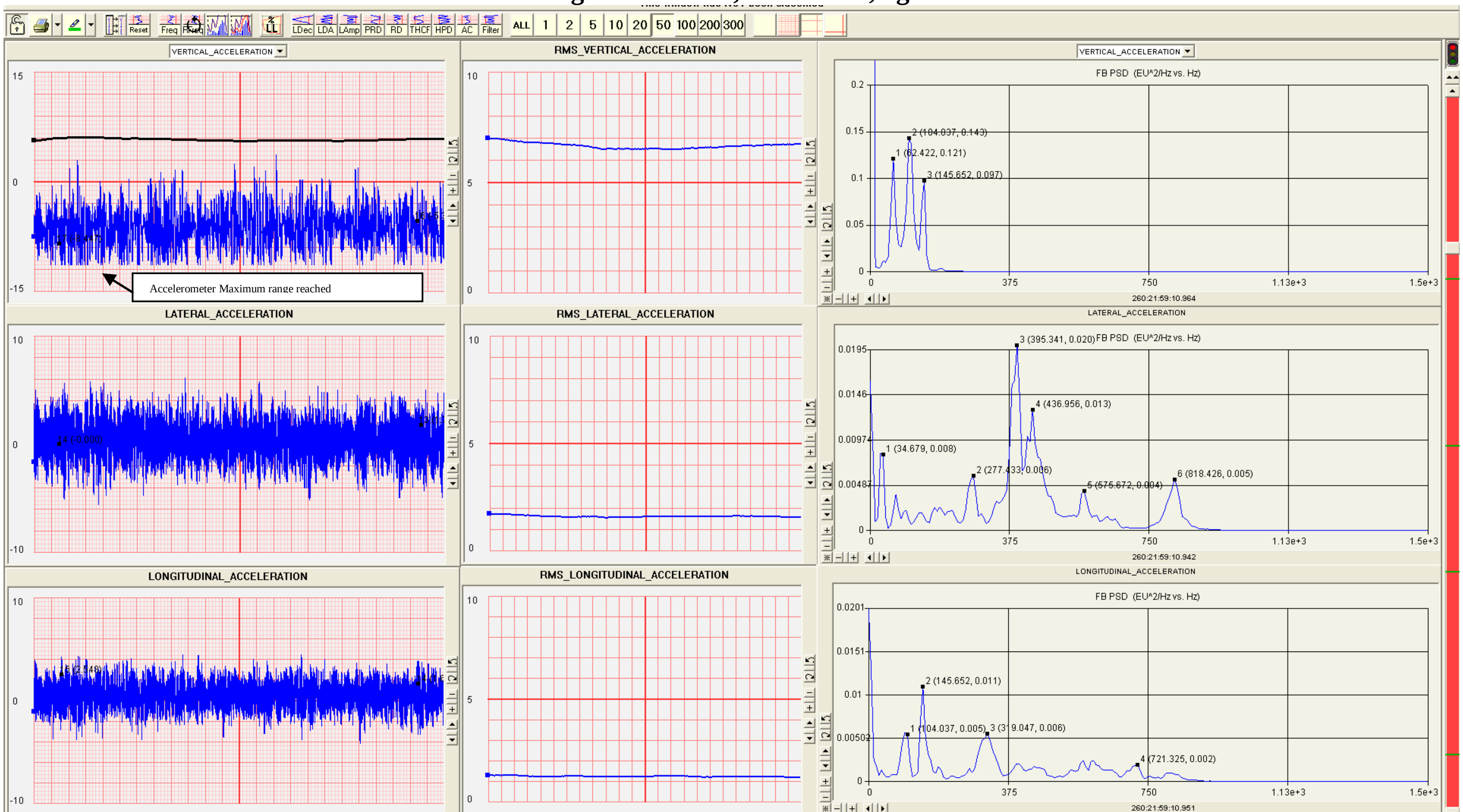
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A14: 5K, 403 KCAS, 3.2g



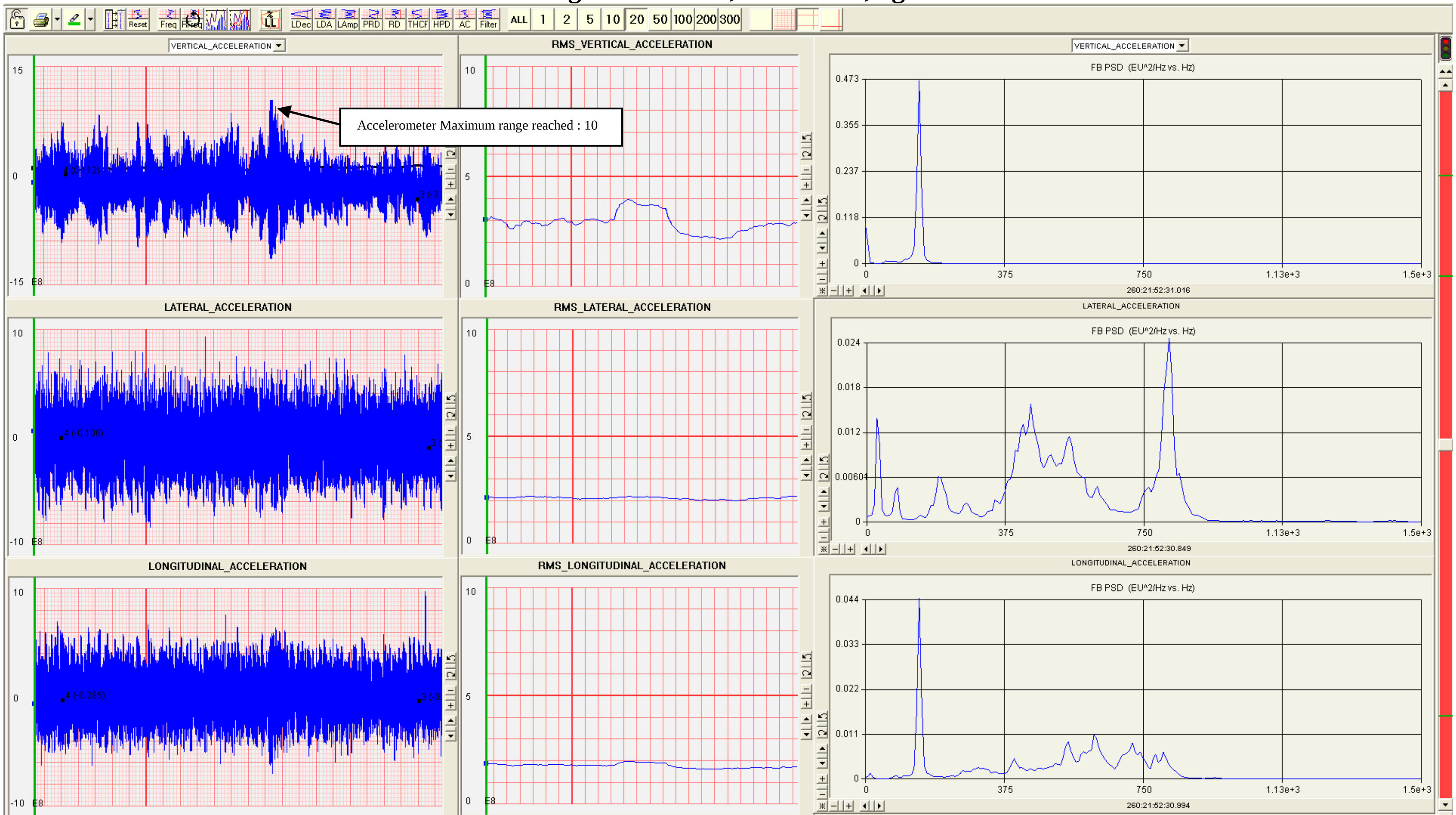
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A15: 5K, 403 KCAS, 6g



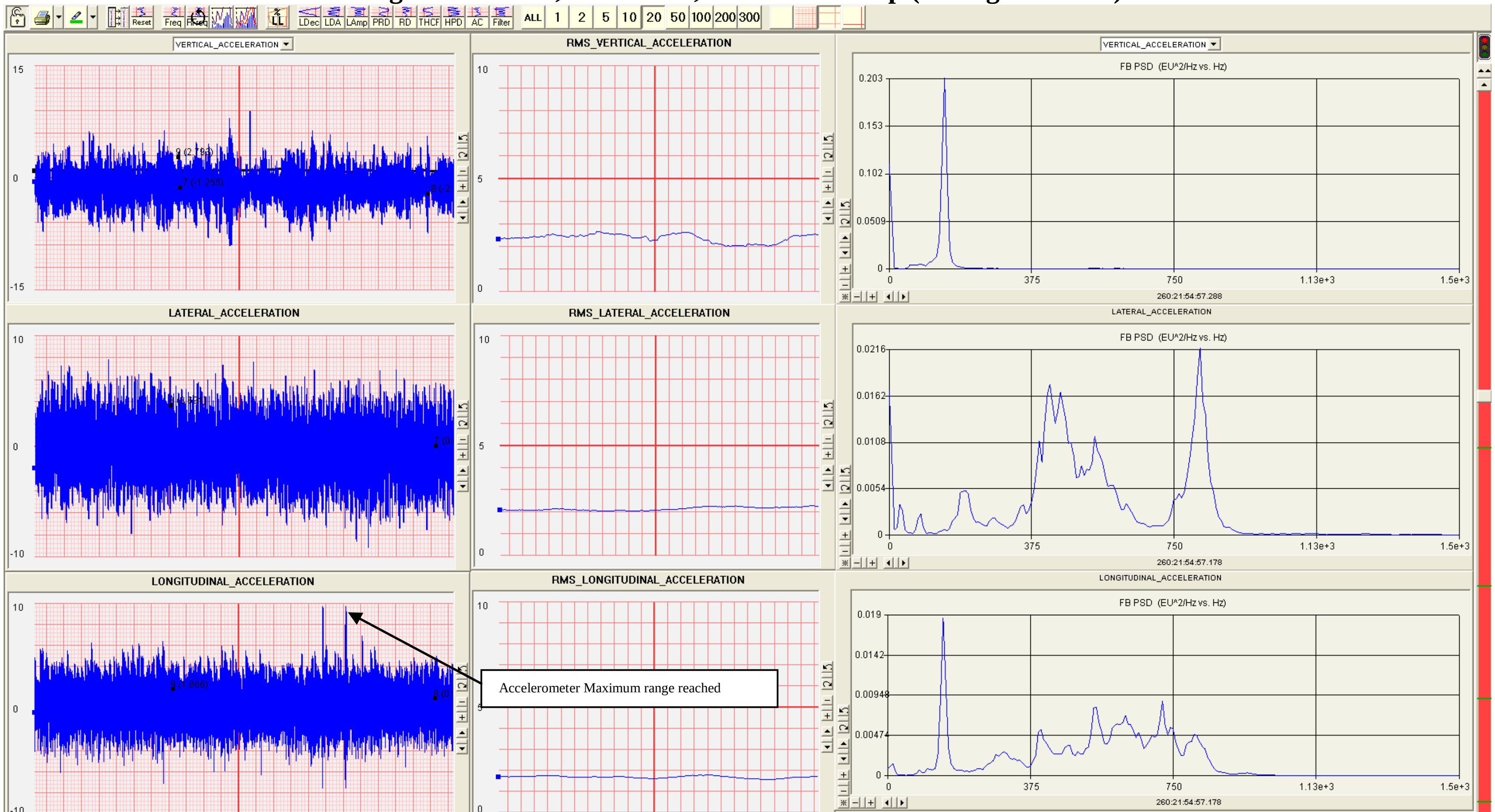
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A16: 5K, 535 KCAS, 1g



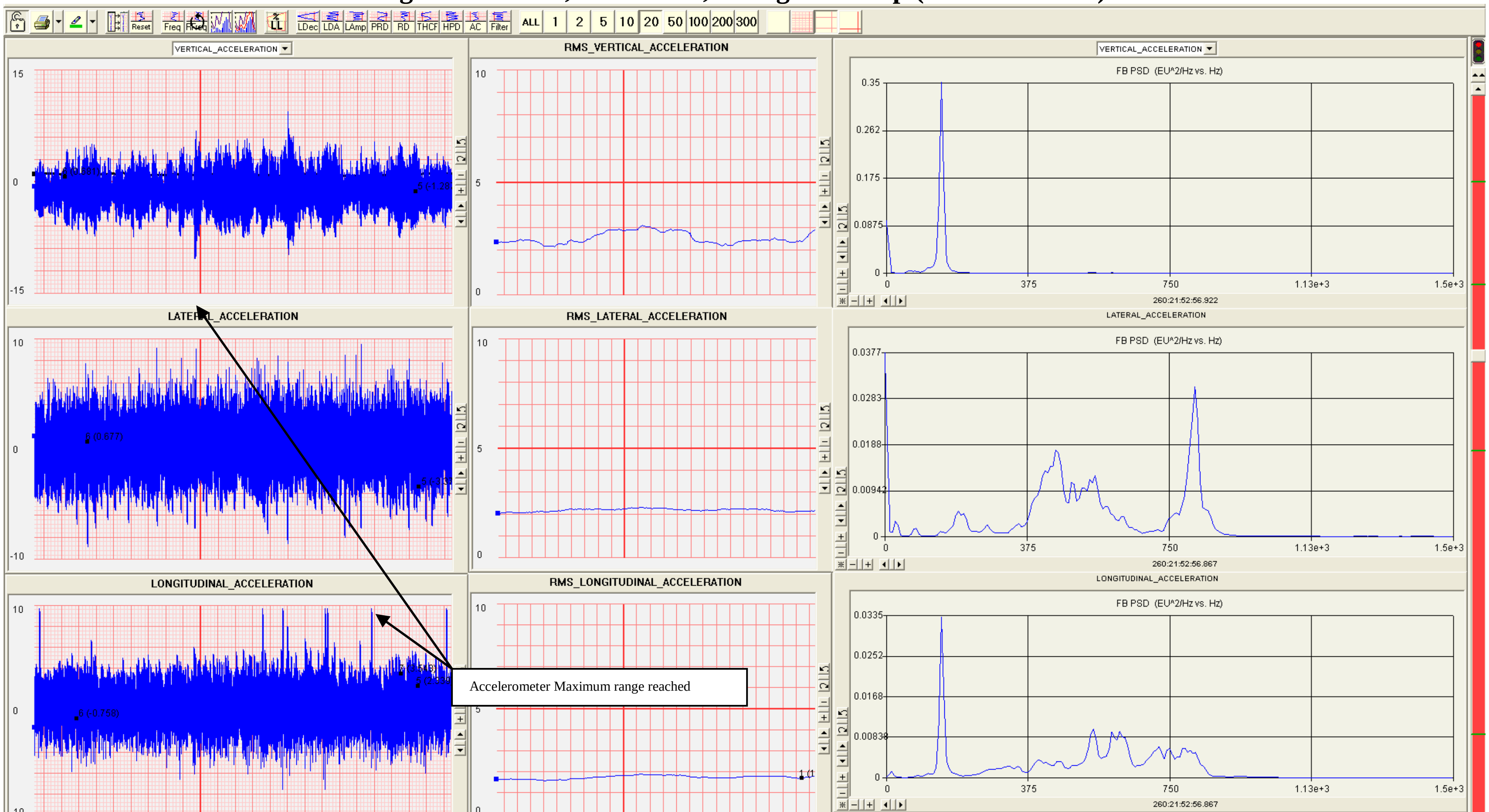
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A17: 5K, 535 KCAS, 4.7° Left sideslip (full right rudder)



Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

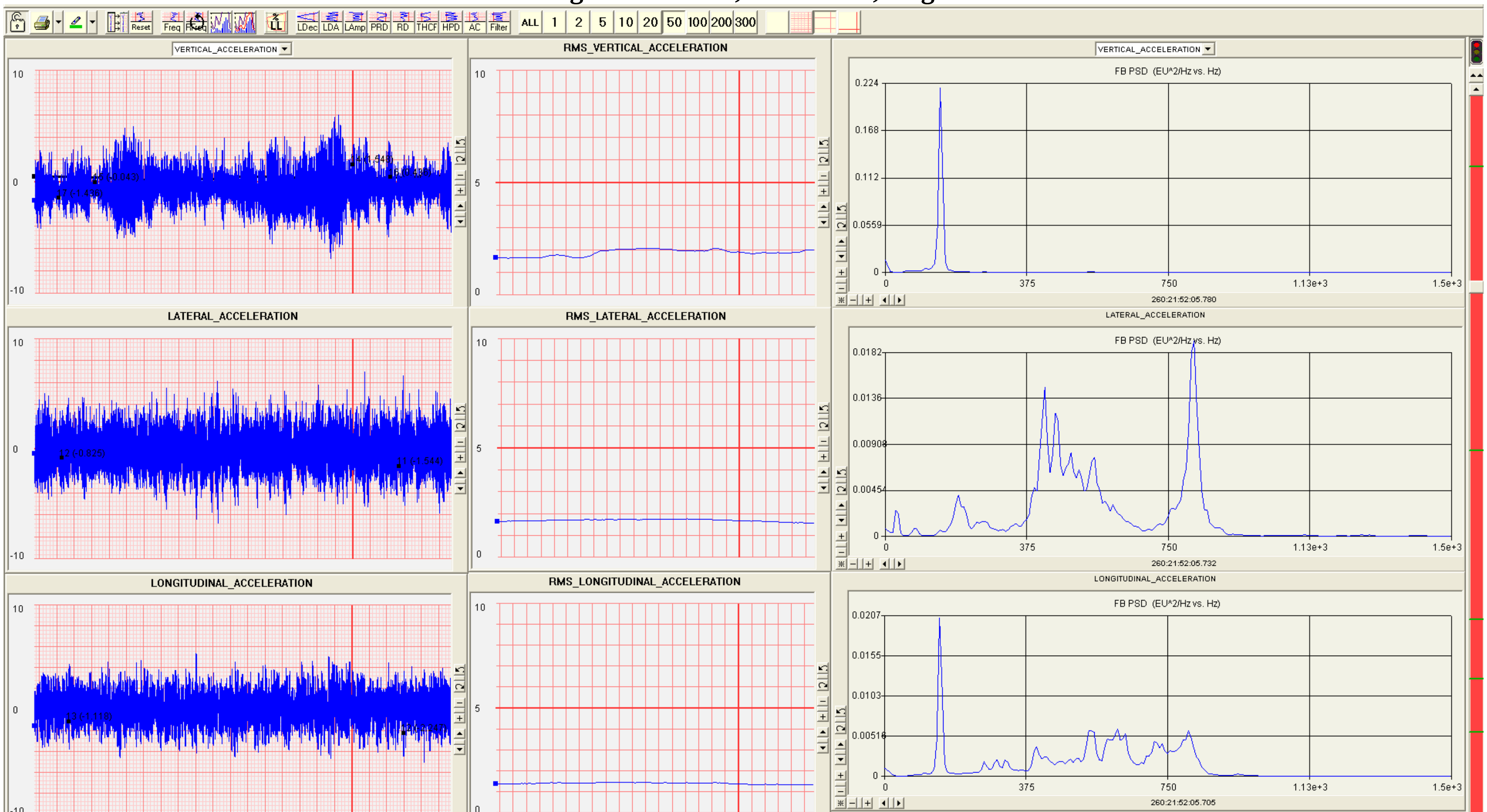
Figure A18: 5K, 535 KCAS, 4° Right sideslip (full left rudder)



Configuration: Cruise
Weight: 37,000 – 22,350 lb
Test Dates: 15 – 18 Sept 2008
All accelerations were in Gs

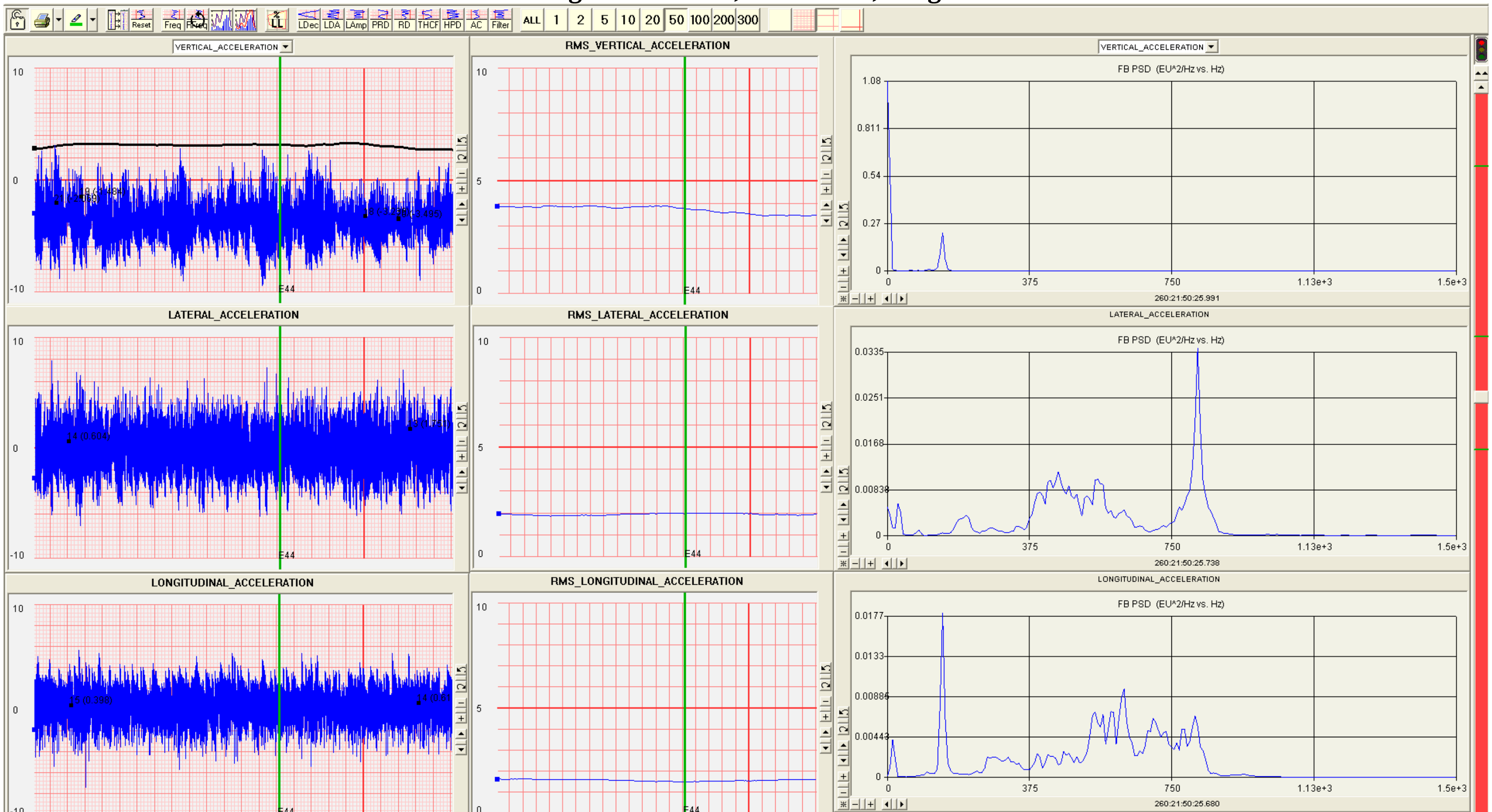
Data Basis: Flight Test
Test Day Data
6 Sec Time Slide
All PSDs were in G^2/HZ

Figure A19: 5K, 535 KCAS, 0.3g



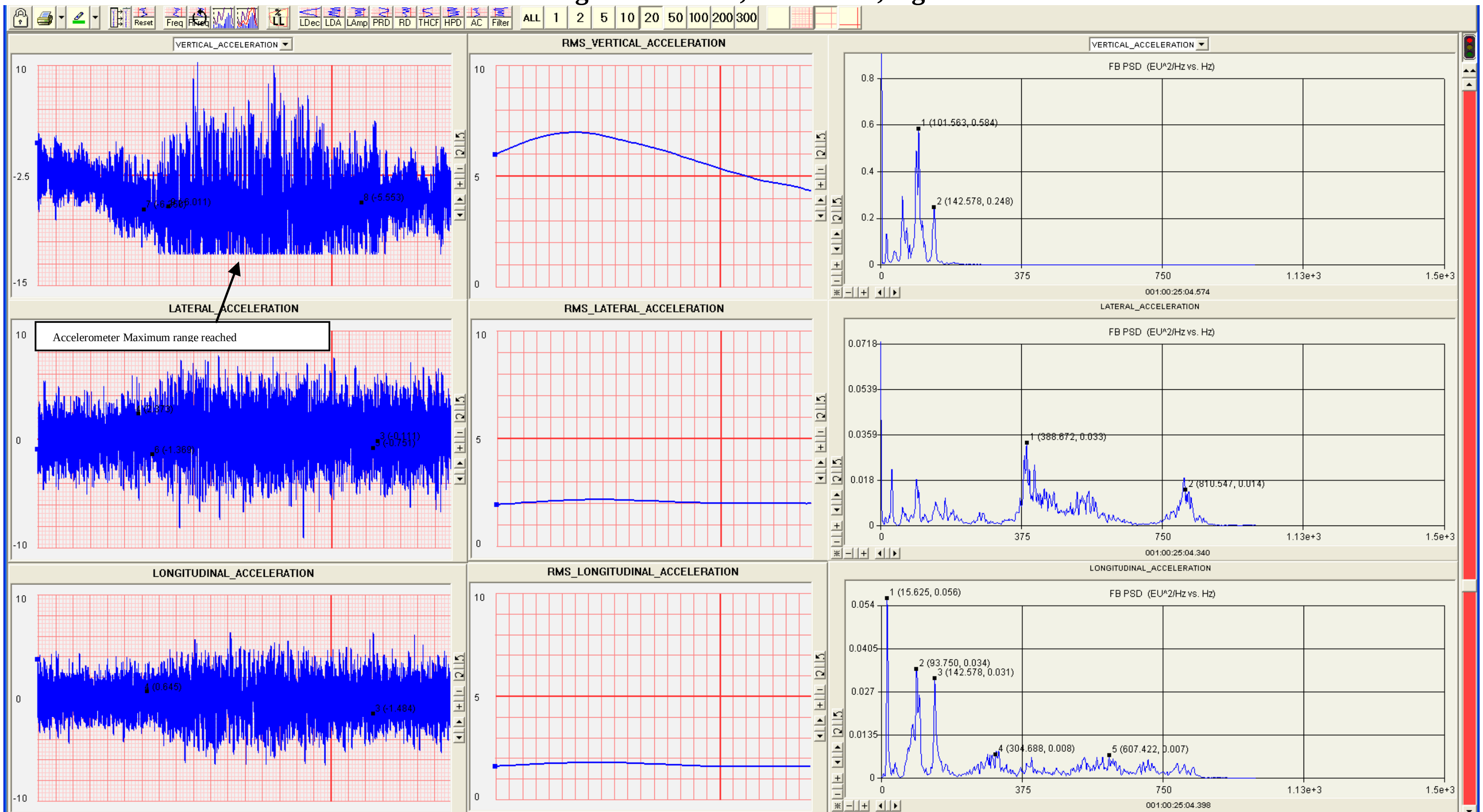
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A20: 5K, 535 KCAS, 3.2 g



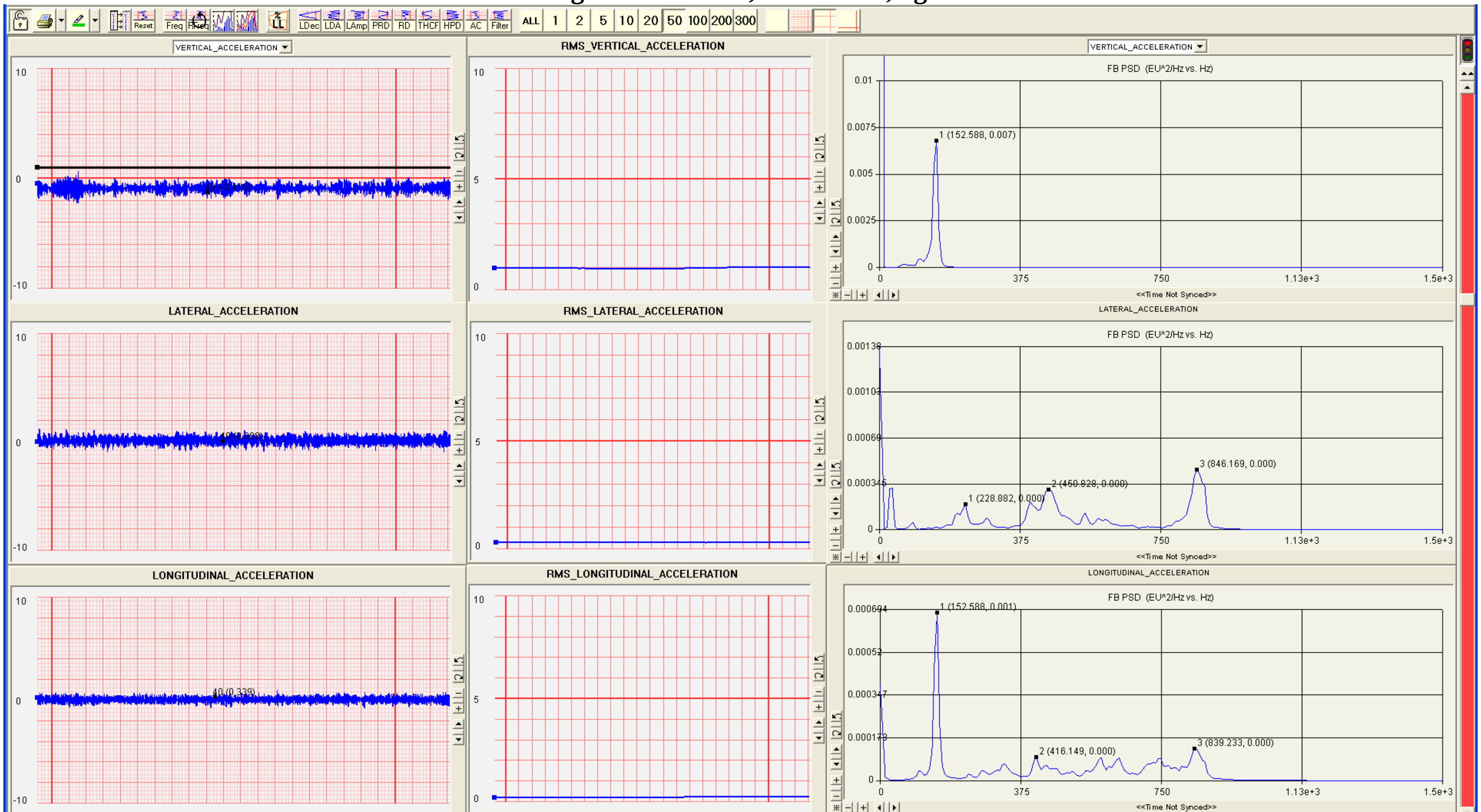
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A21: 5K, 535 KCAS, 6 g



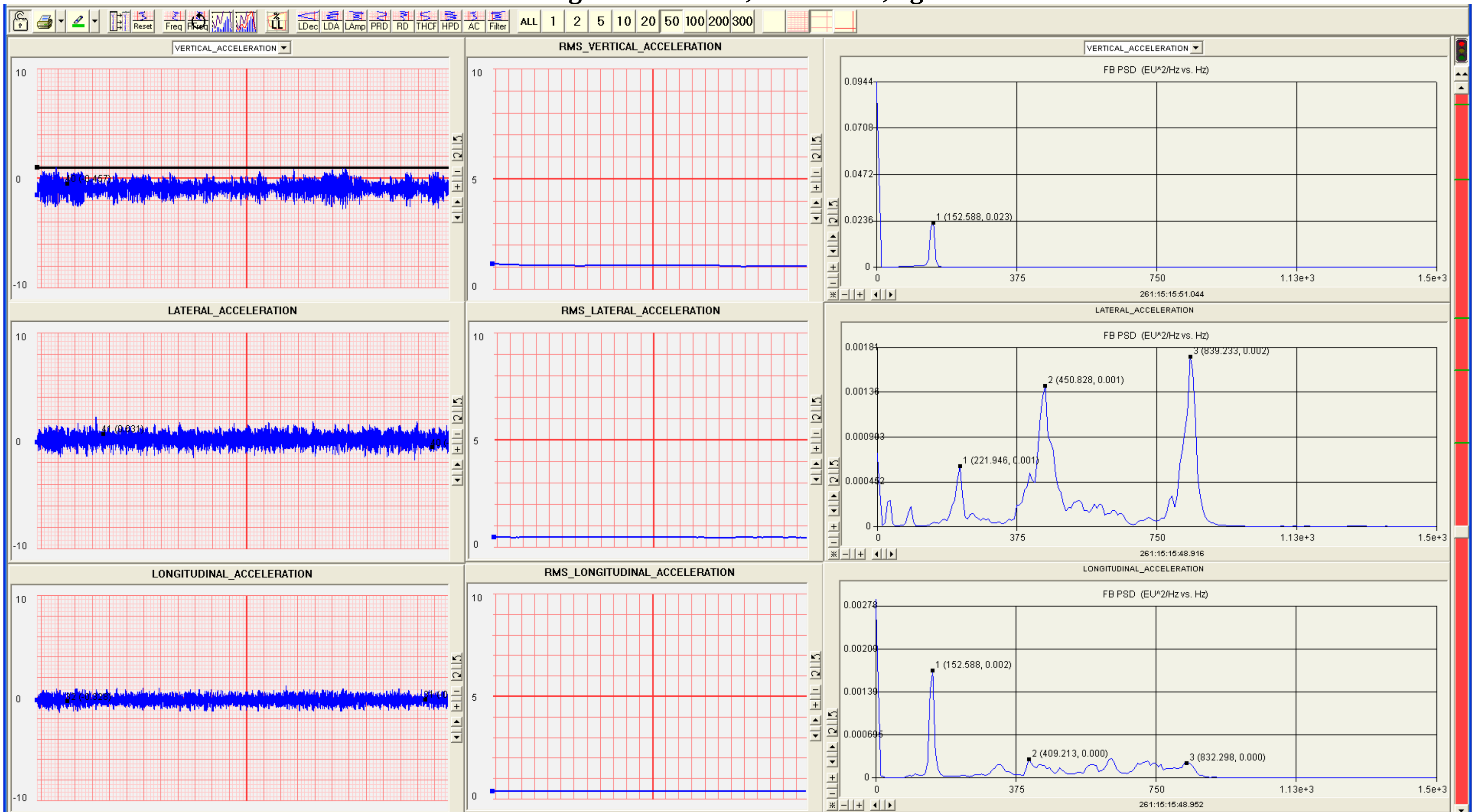
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A22: 15K, 250 KCAS, 1g



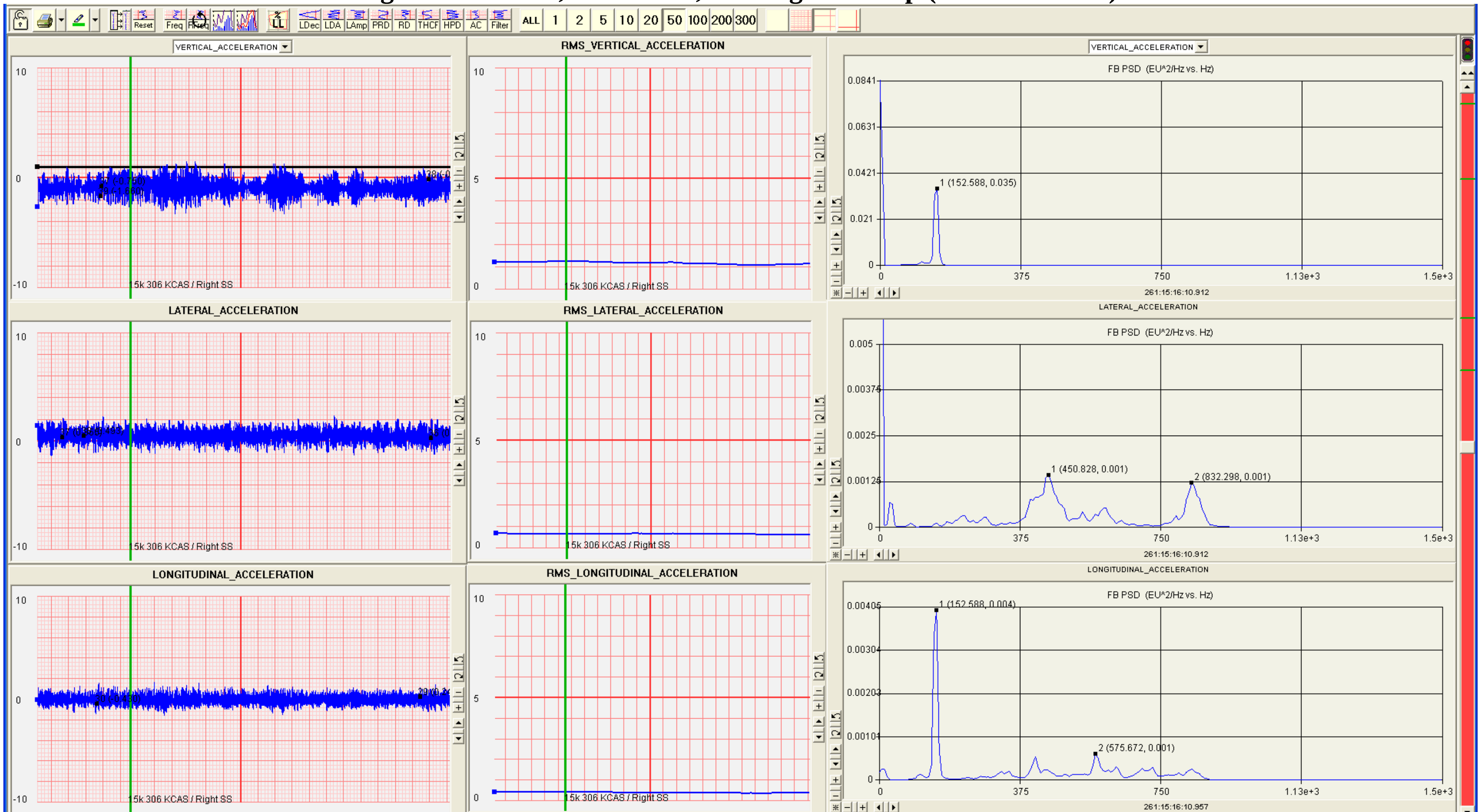
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A23: 15K, 306 KCAS, 1g



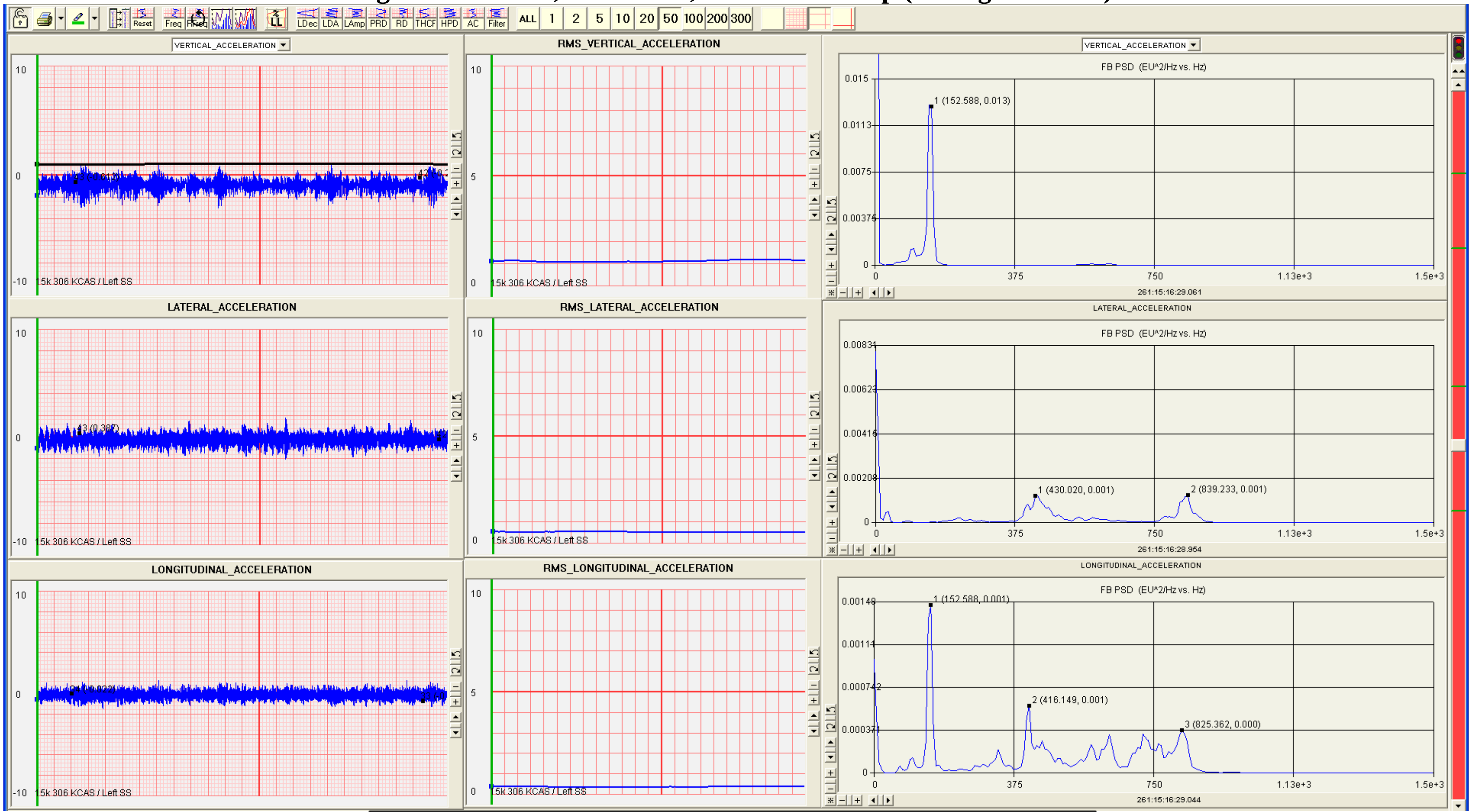
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A24: 15K, 306 KCAS, 7.5° Right sideslip (full left rudder)



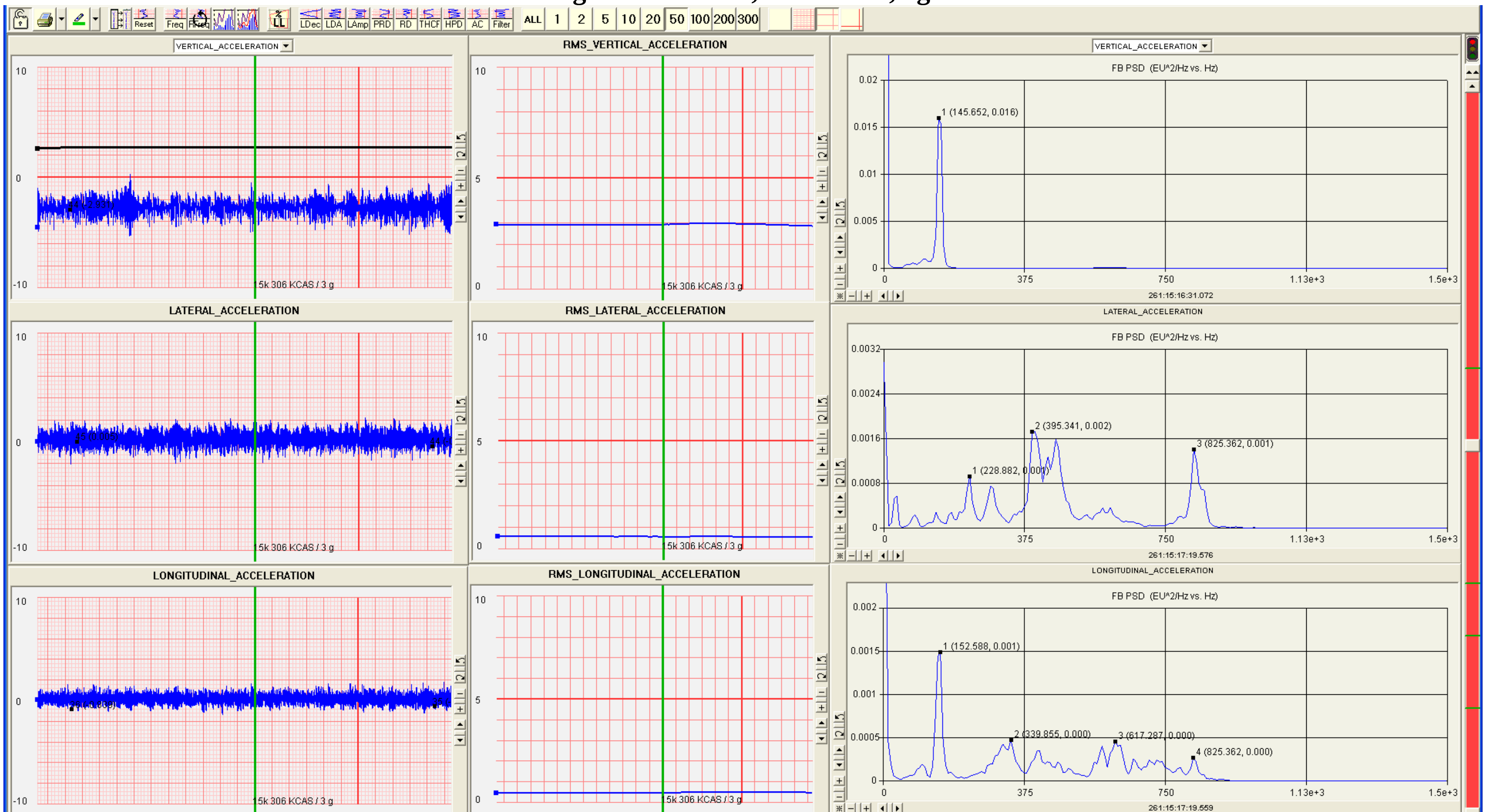
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A25: 15K, 306 KCAS, 9.5° Left sideslip (full right rudder)



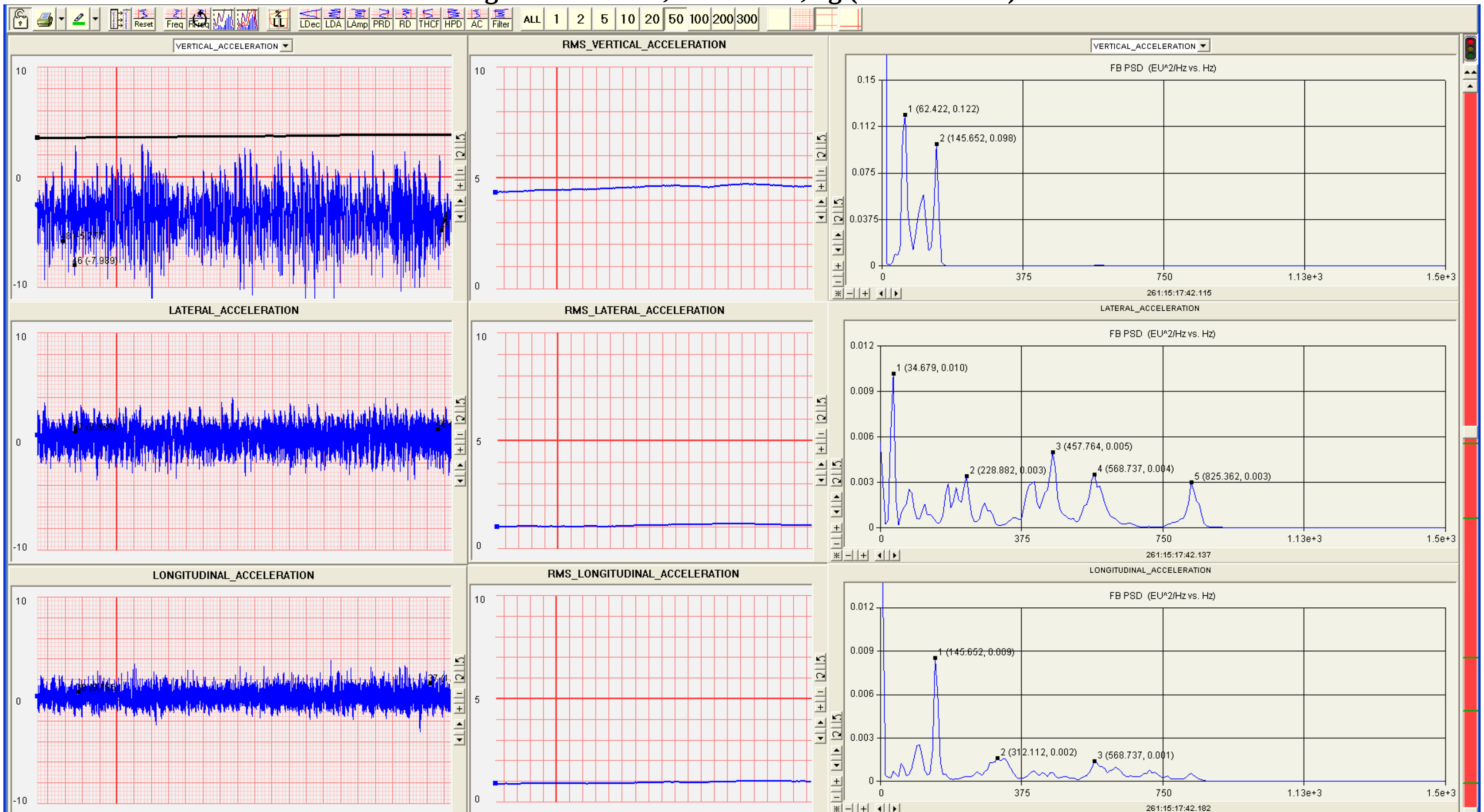
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A26: 15K, 306 KCAS, 3g



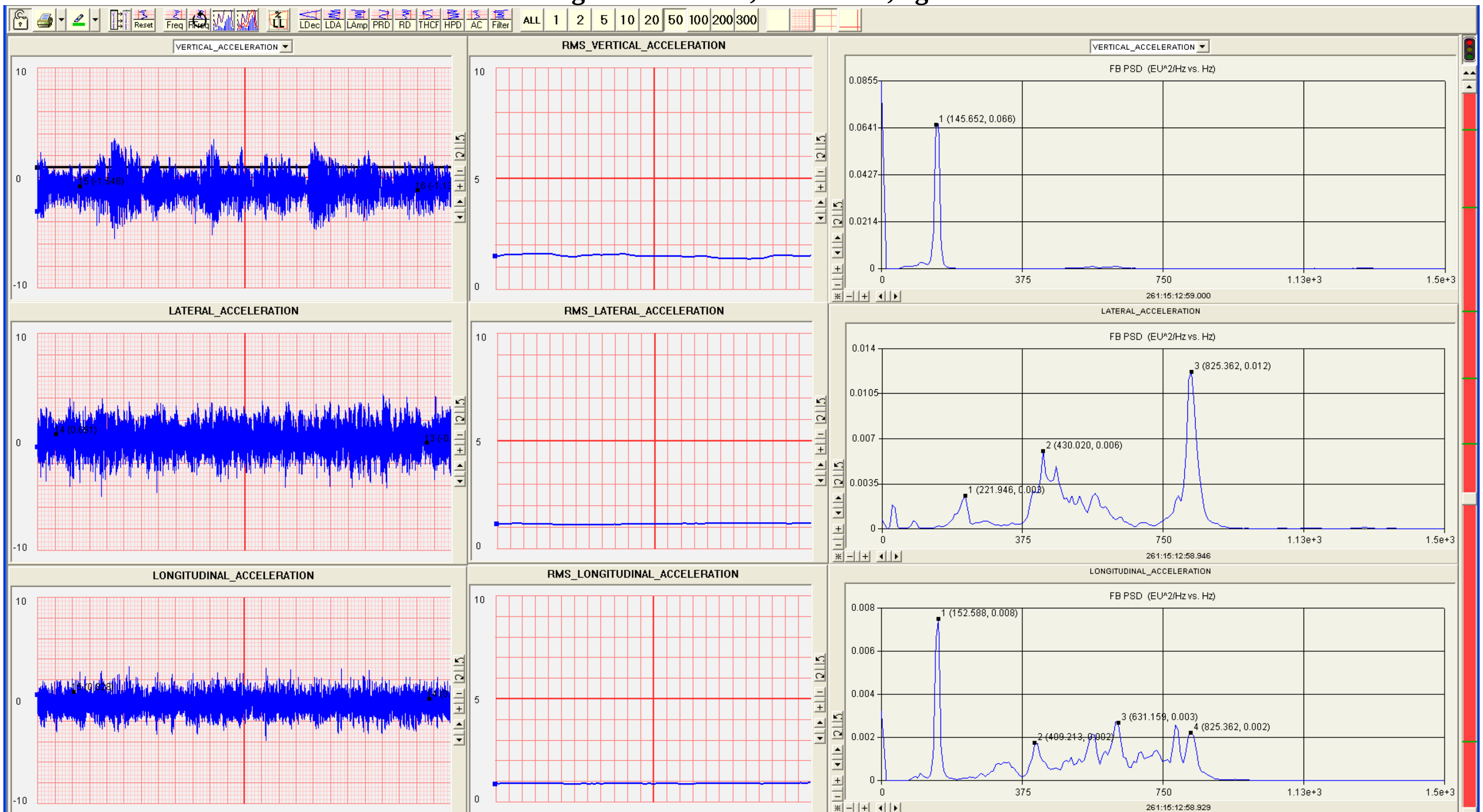
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A27: 15K, 306 KCAS, 4g (AOA limited)



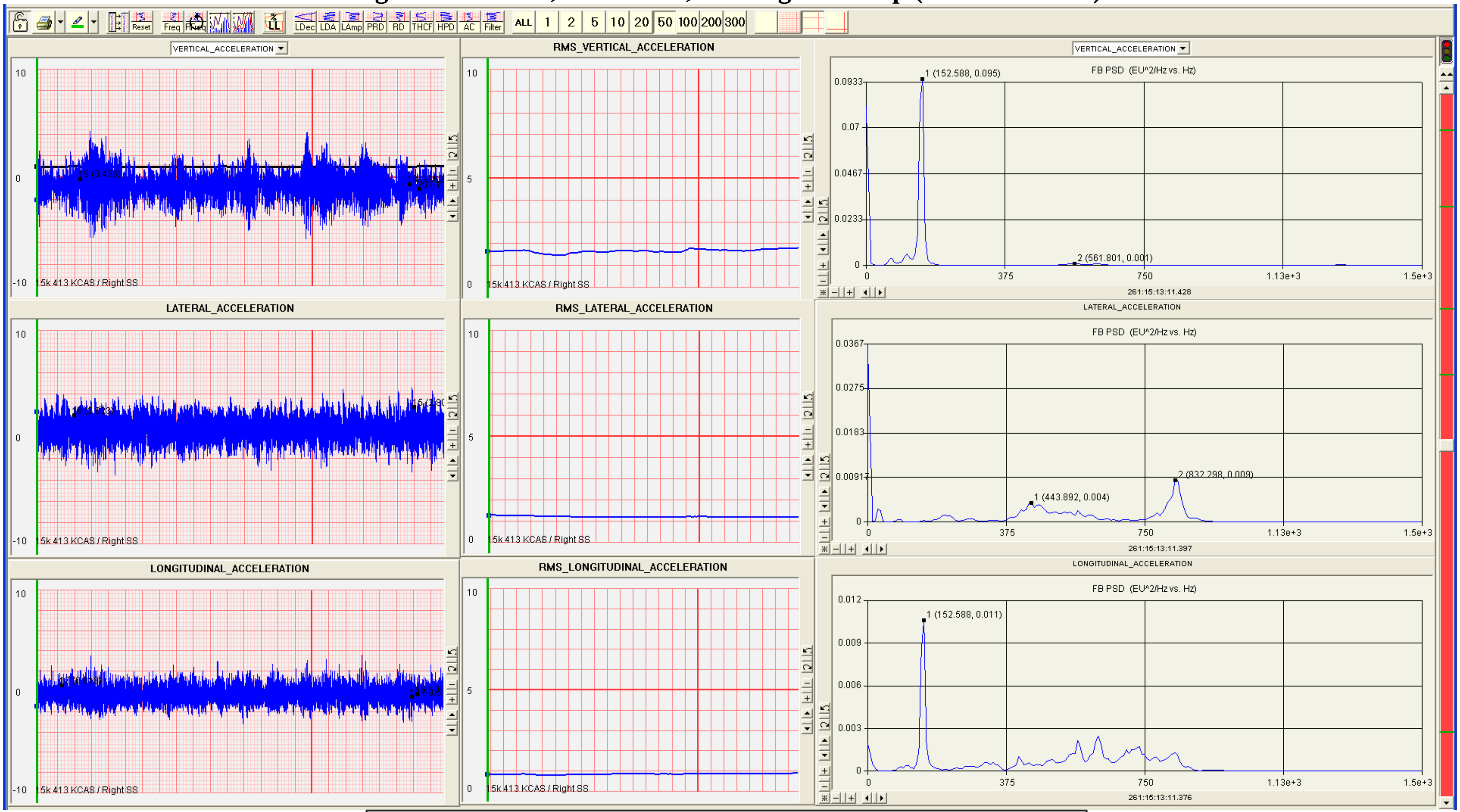
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A28: 15K, 413 KCAS, 1g



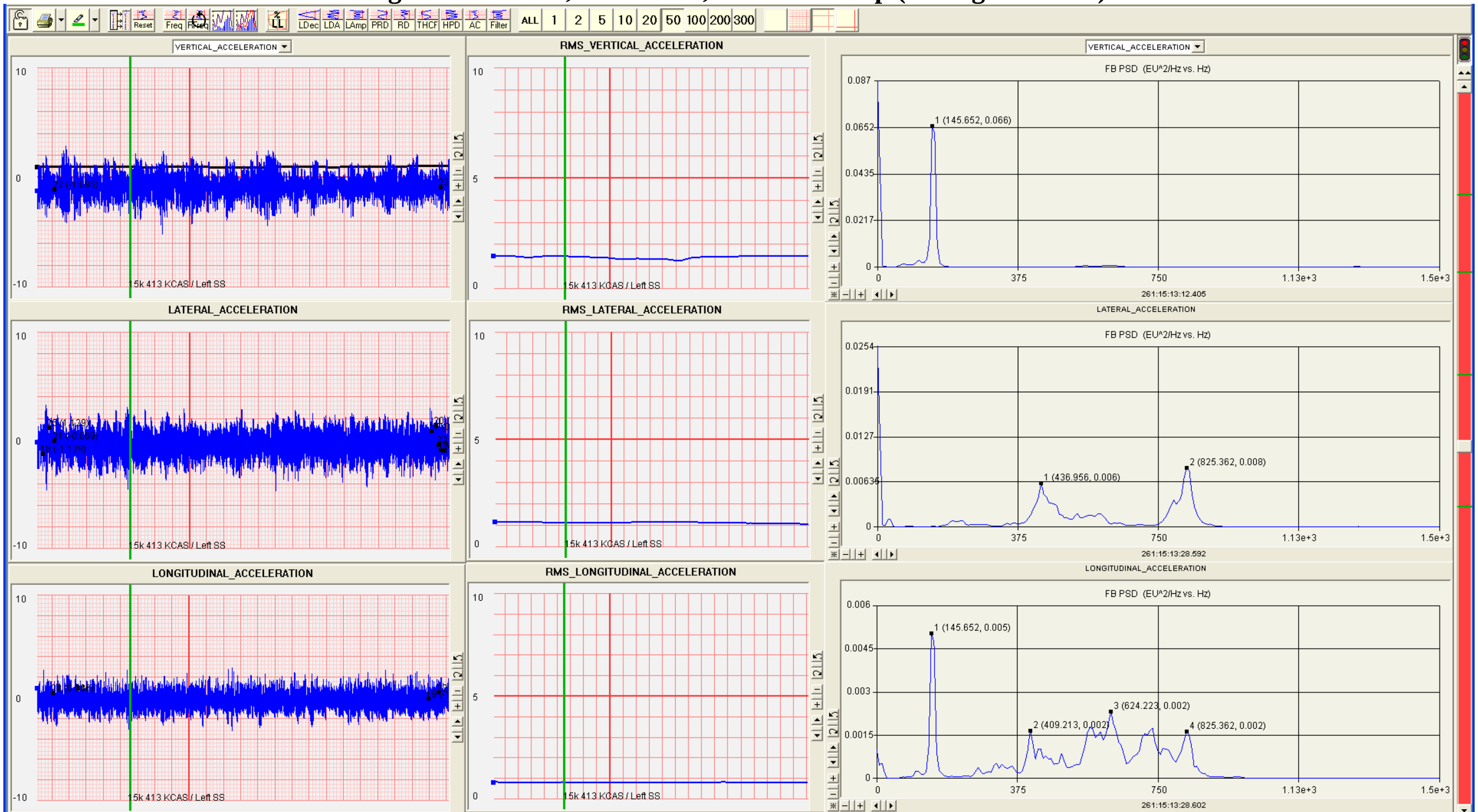
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A29: 15K, 413 KCAS, 5.4° Right sideslip (full left rudder)



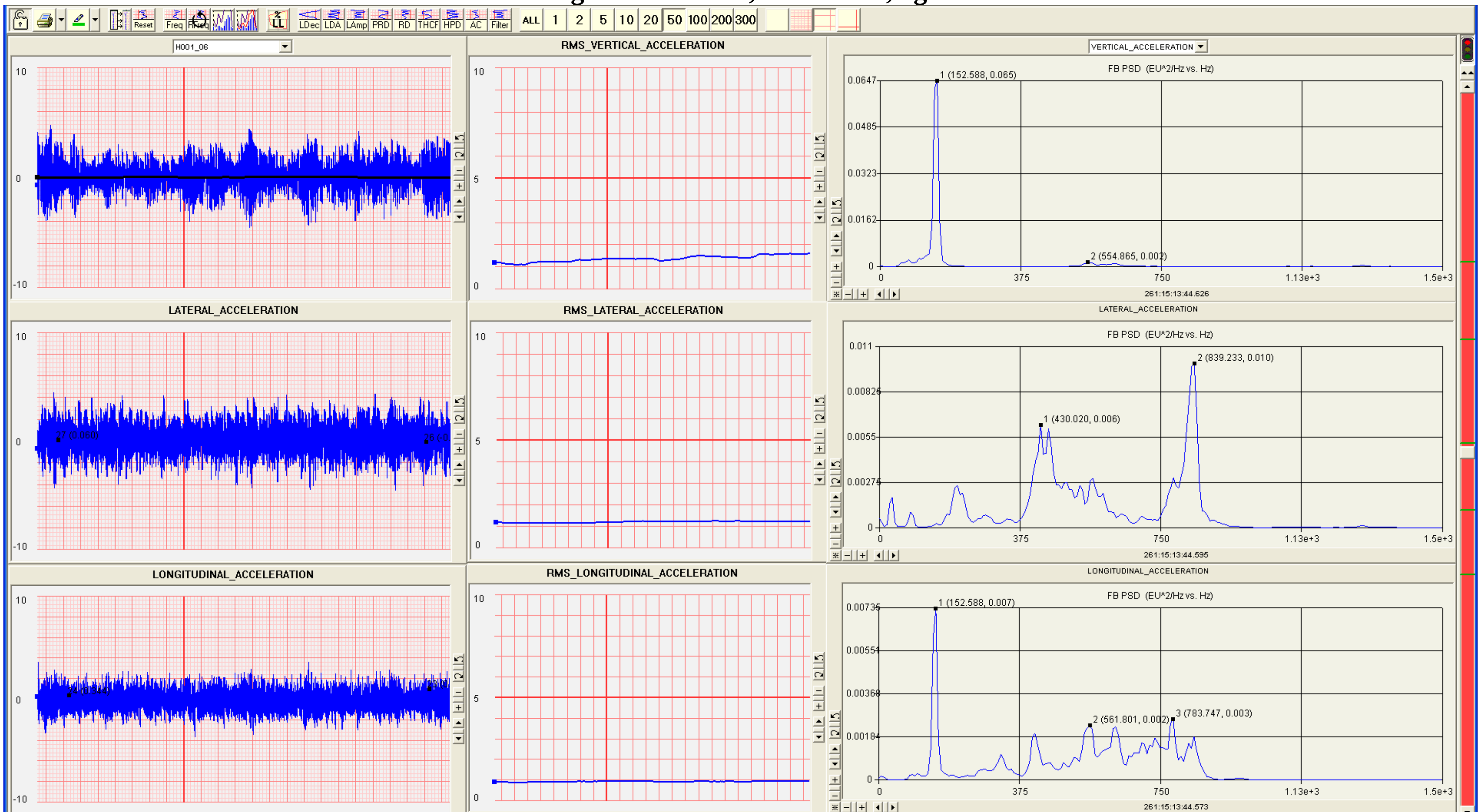
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A30: 15K, 413 KCAS, 8° Left sideslip (full right rudder)



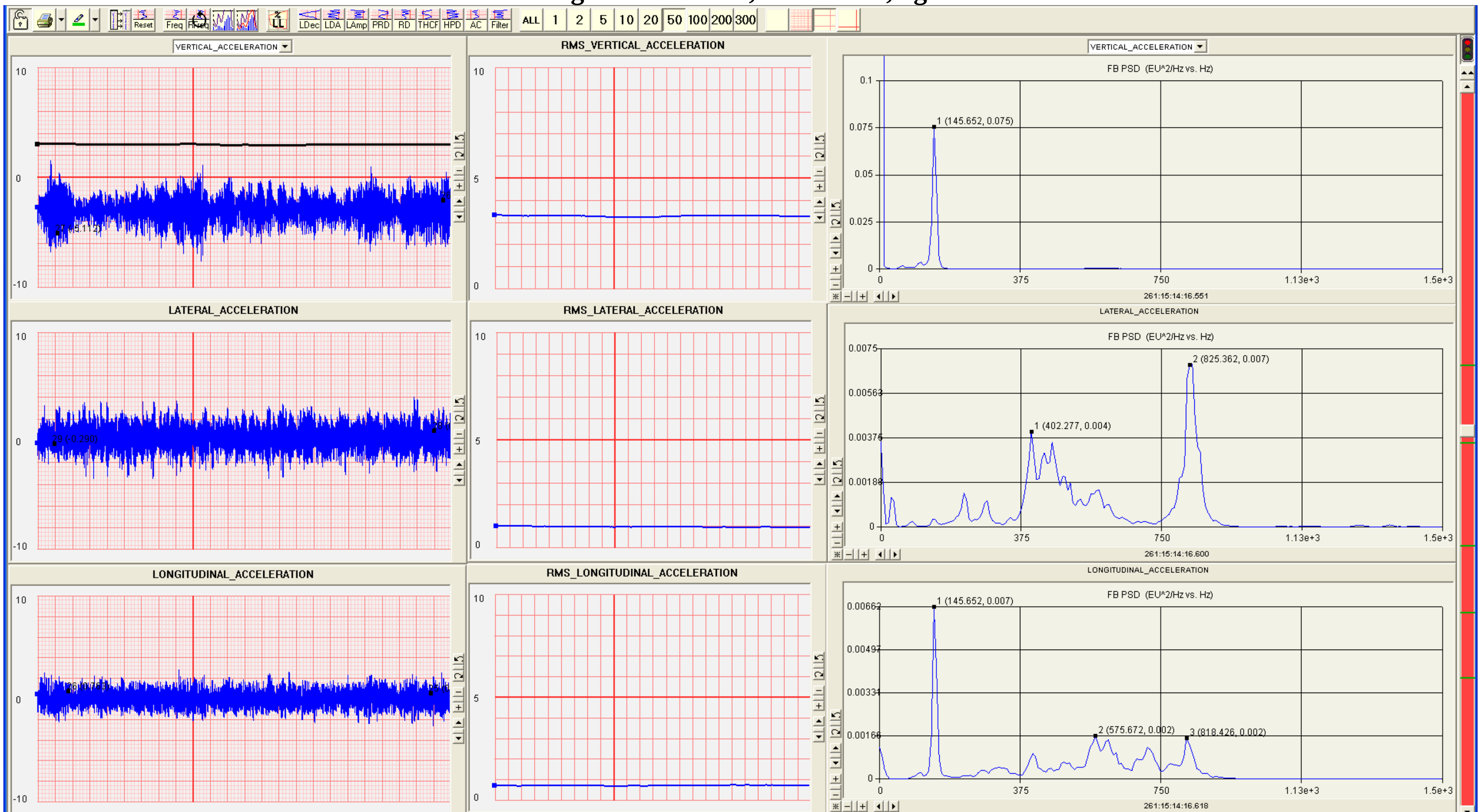
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A31: 15K, 413 KCAS, 0g



Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

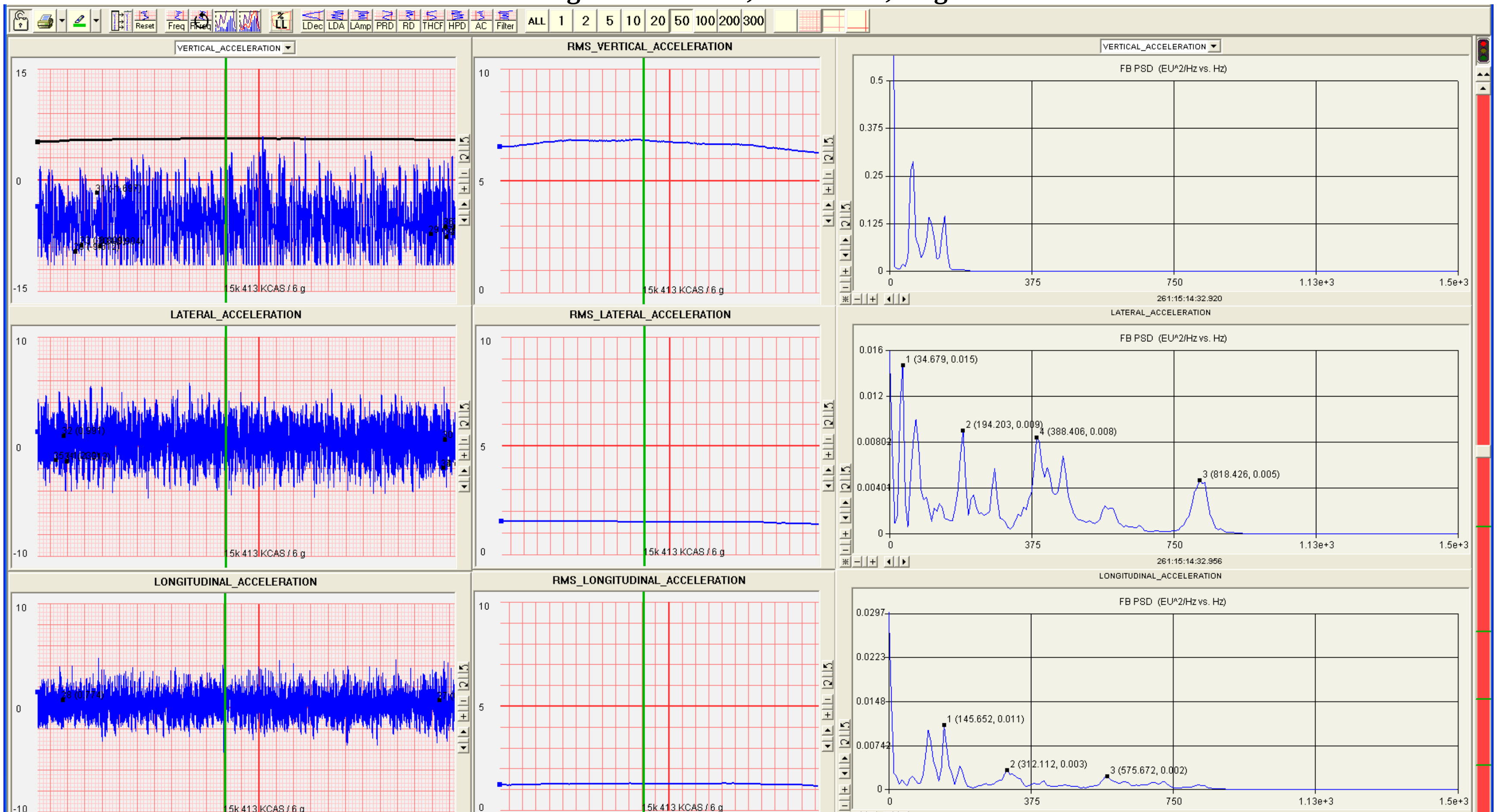
Figure A32: 15K, 413 KCAS, 3g



Configuration: Cruise
Weight: 37,000 – 22,350 lb
Test Dates: 15 – 18 Sept 2008
All accelerations were in Gs

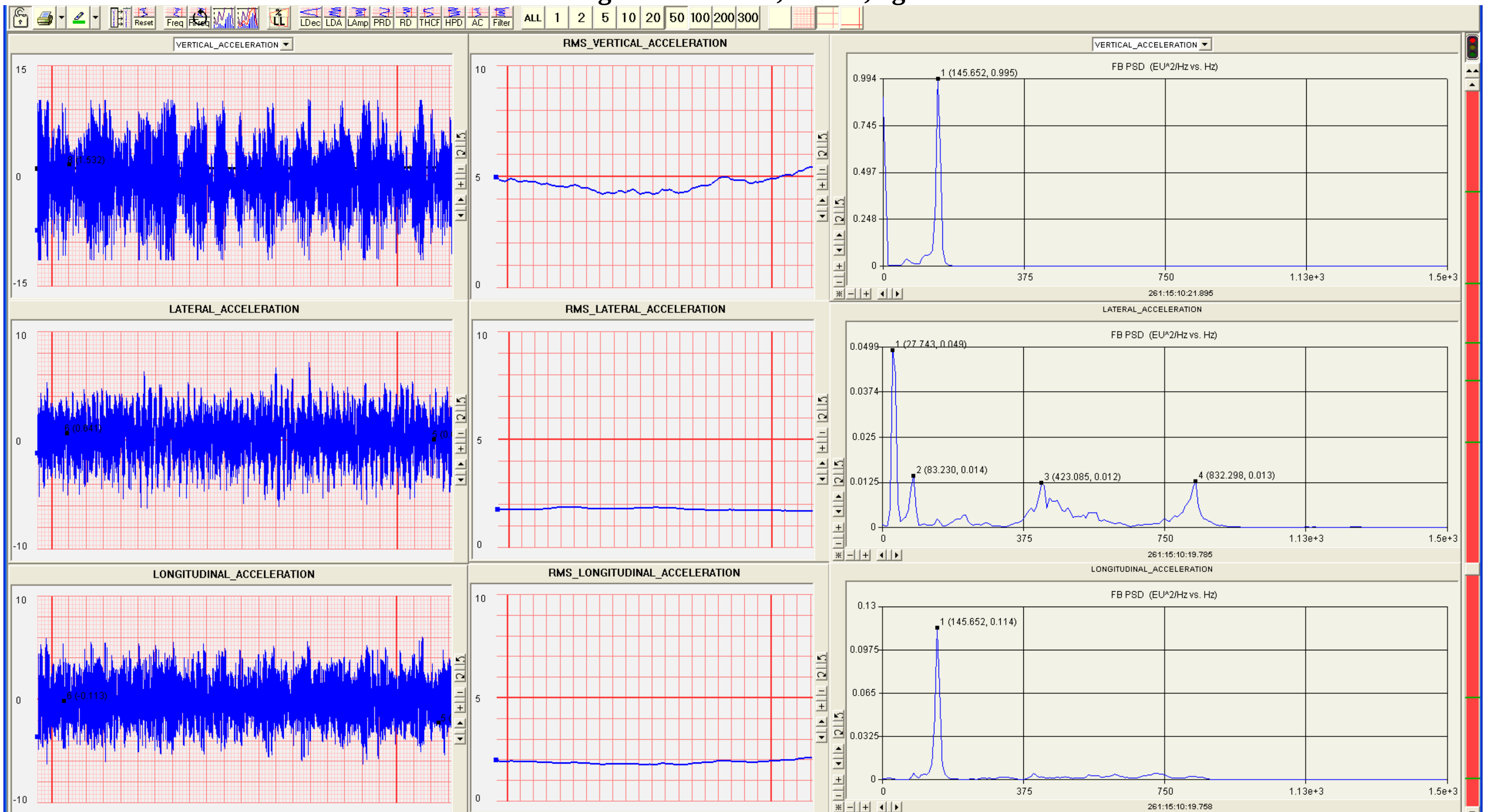
Data Basis: Flight Test
Test Day Data
2.5 Sec Time Slide
All PSDs were in G^2/HZ

Figure A33: 15K, 413 KCAS, 5.7g



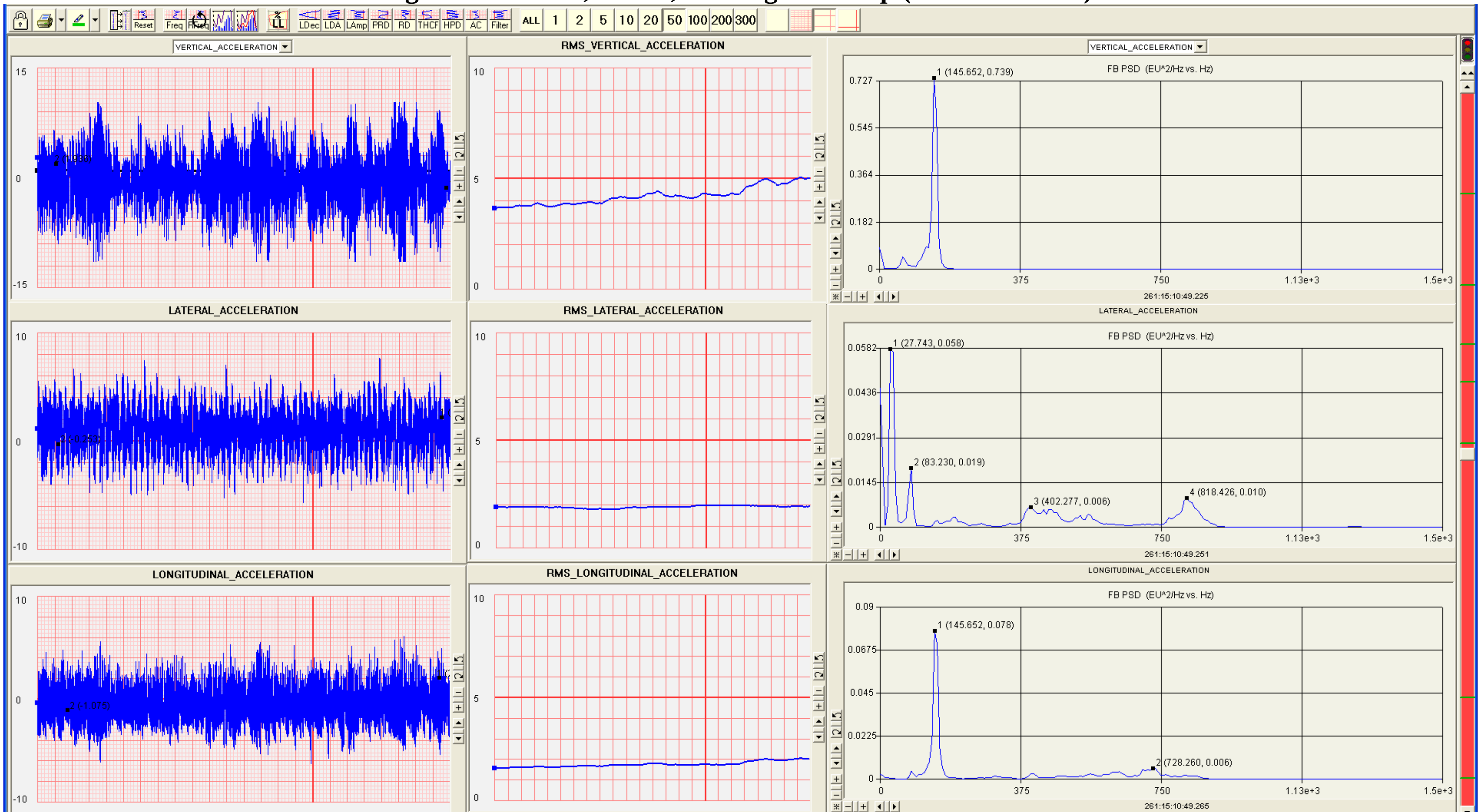
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A34: 15K, 0.94M, 1g



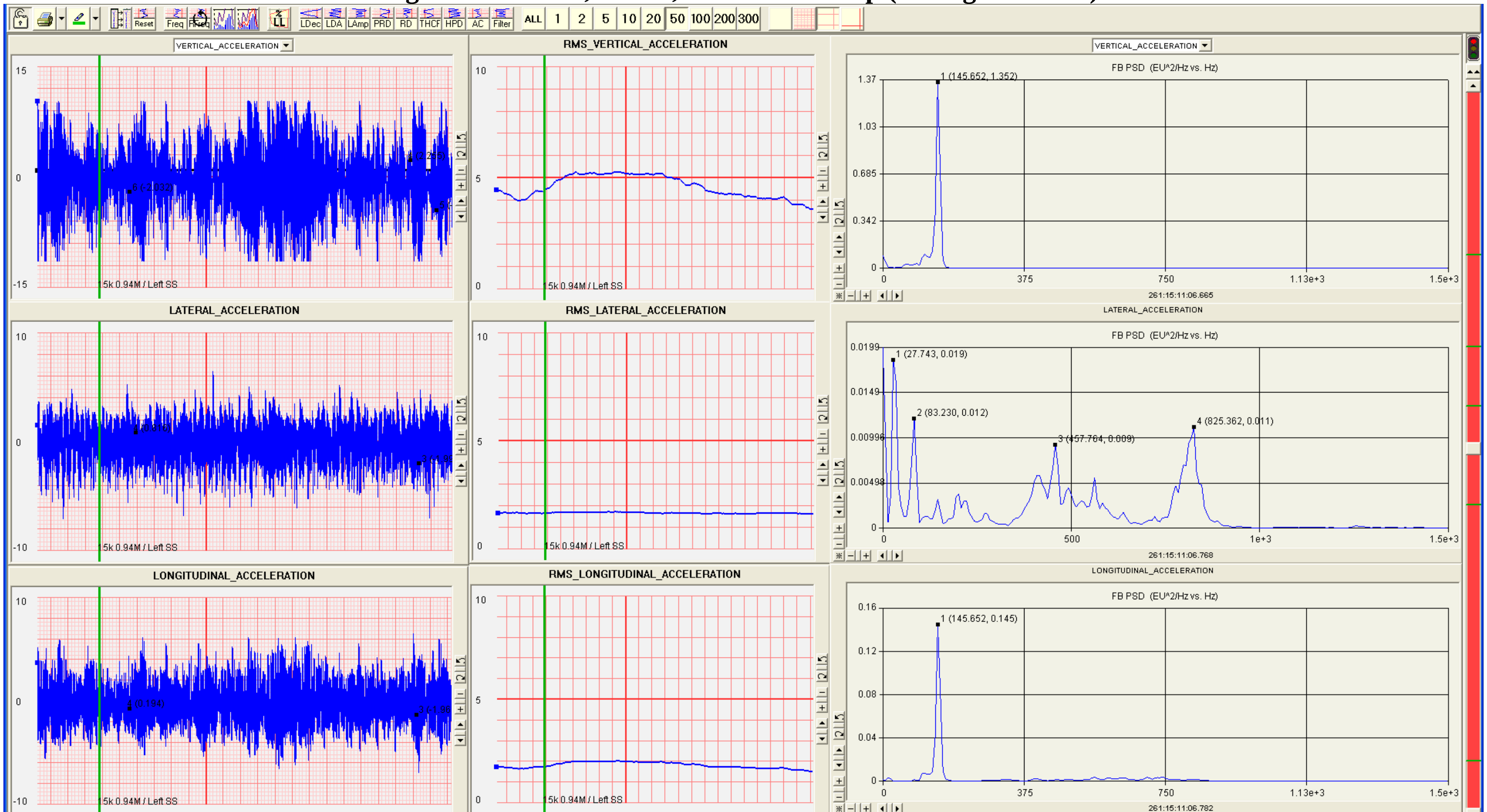
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A35: 15K, 0.94M, 4.8° Right sideslip (full left rudder)



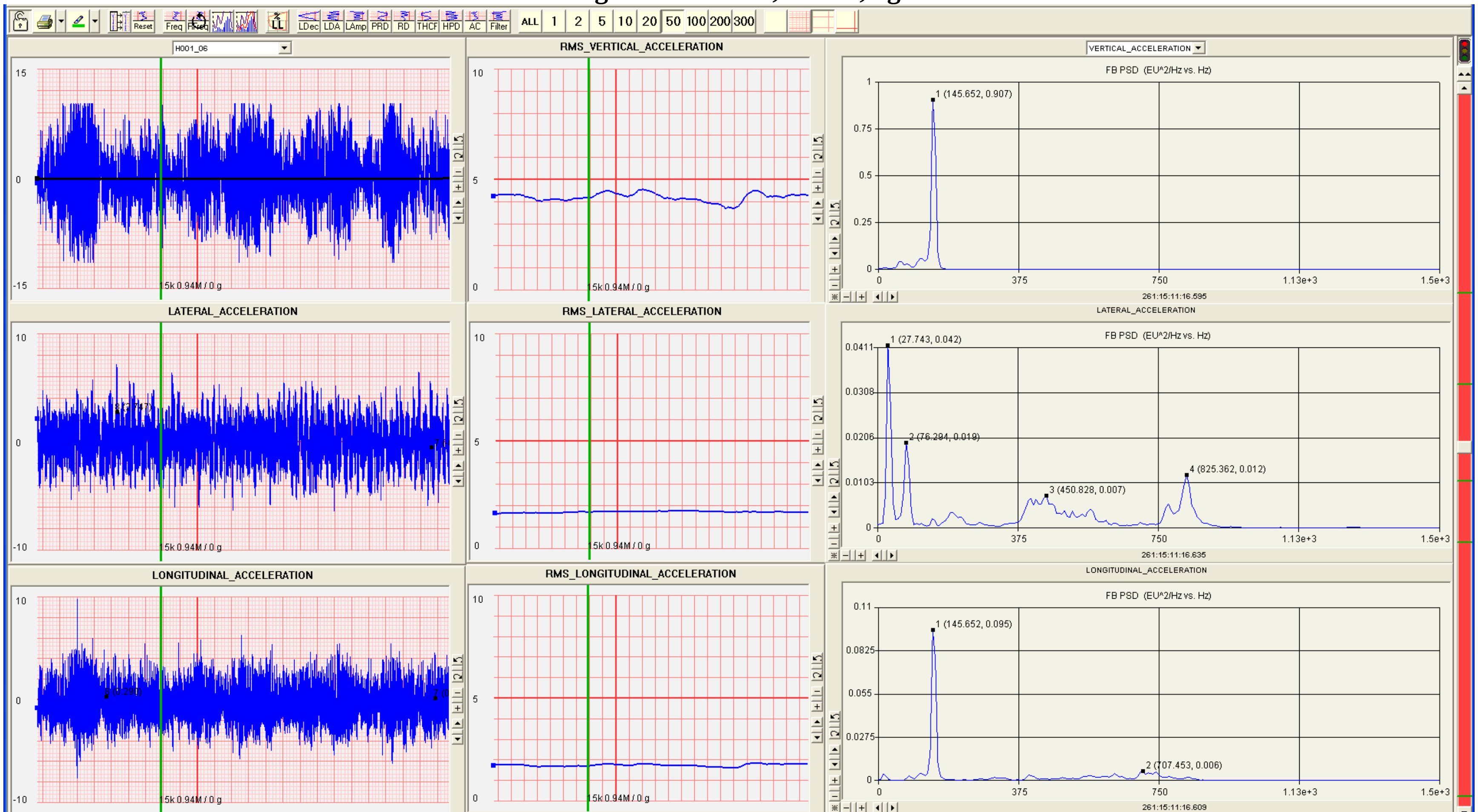
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A36: 15K, 0.94M, 5.2° Left sideslip (full right rudder)



Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

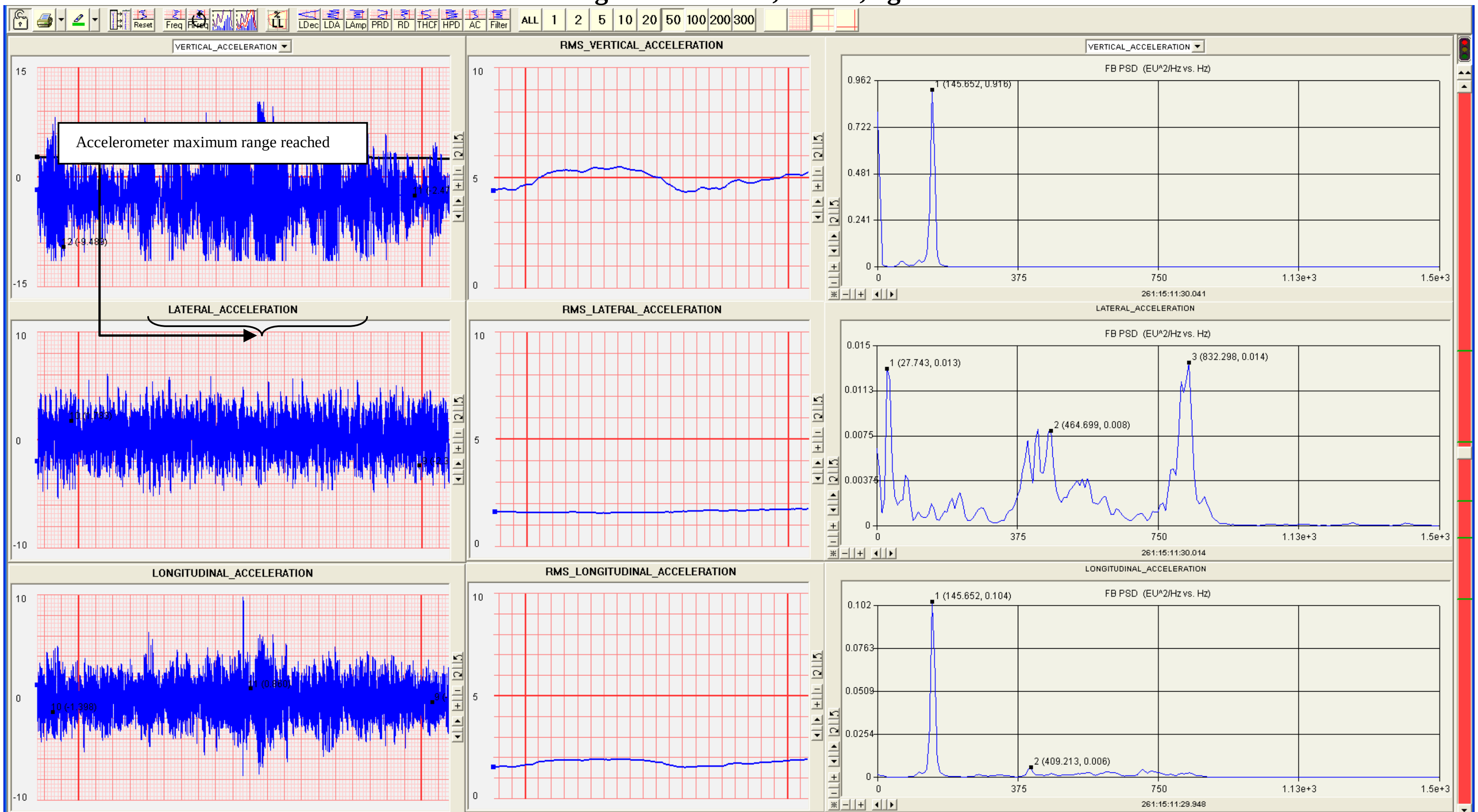
Figure A37: 15K, 0.94M, 0g



Configuration: Cruise
Weight: 37,000 – 22,350 lb
Test Dates: 15 – 18 Sept 2008
All accelerations were in Gs

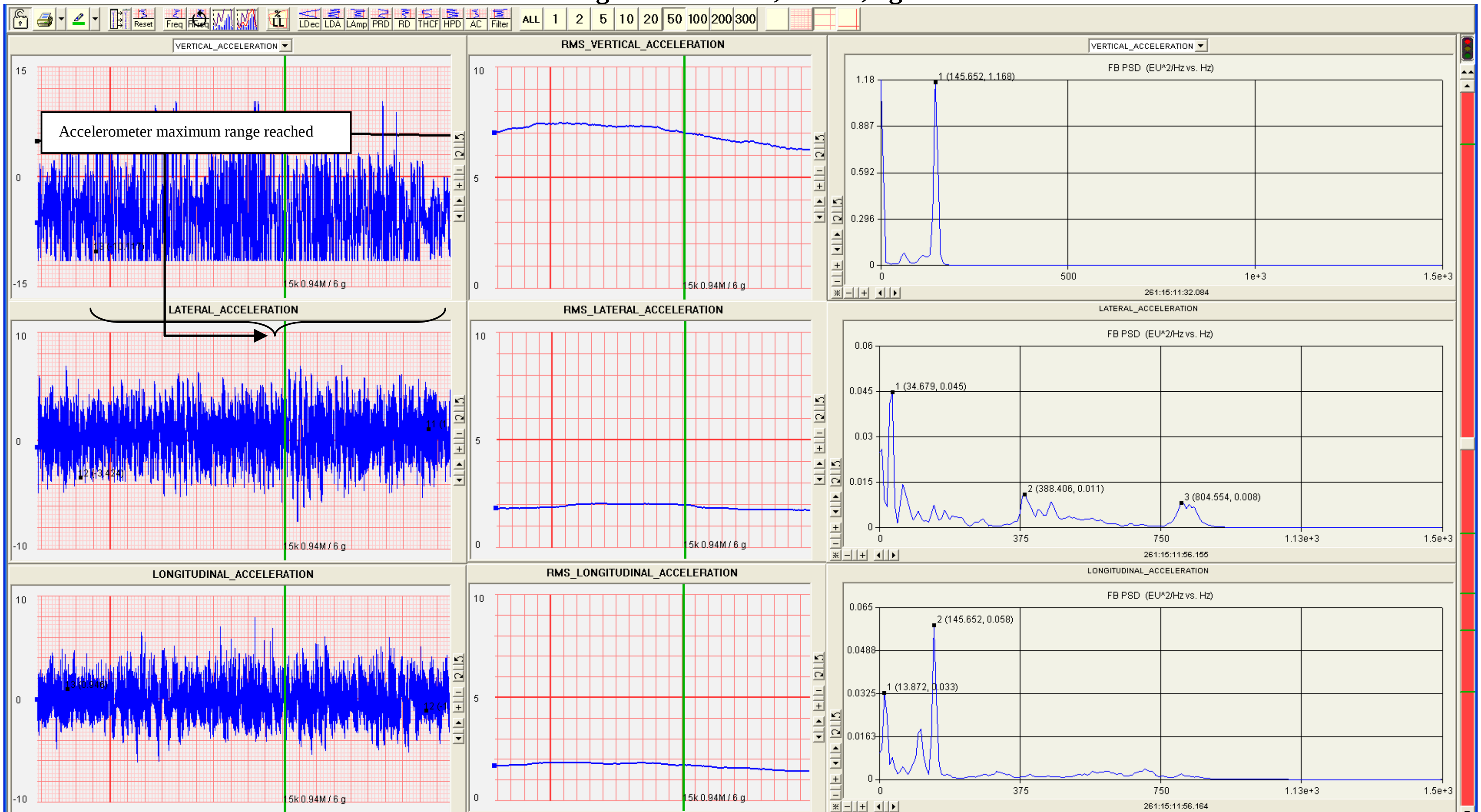
Data Basis: Flight Test
Test Day Data
2.5 Sec Time Slide
All PSDs were in G^2/HZ

Figure A38: 15K, 0.94M, 3g



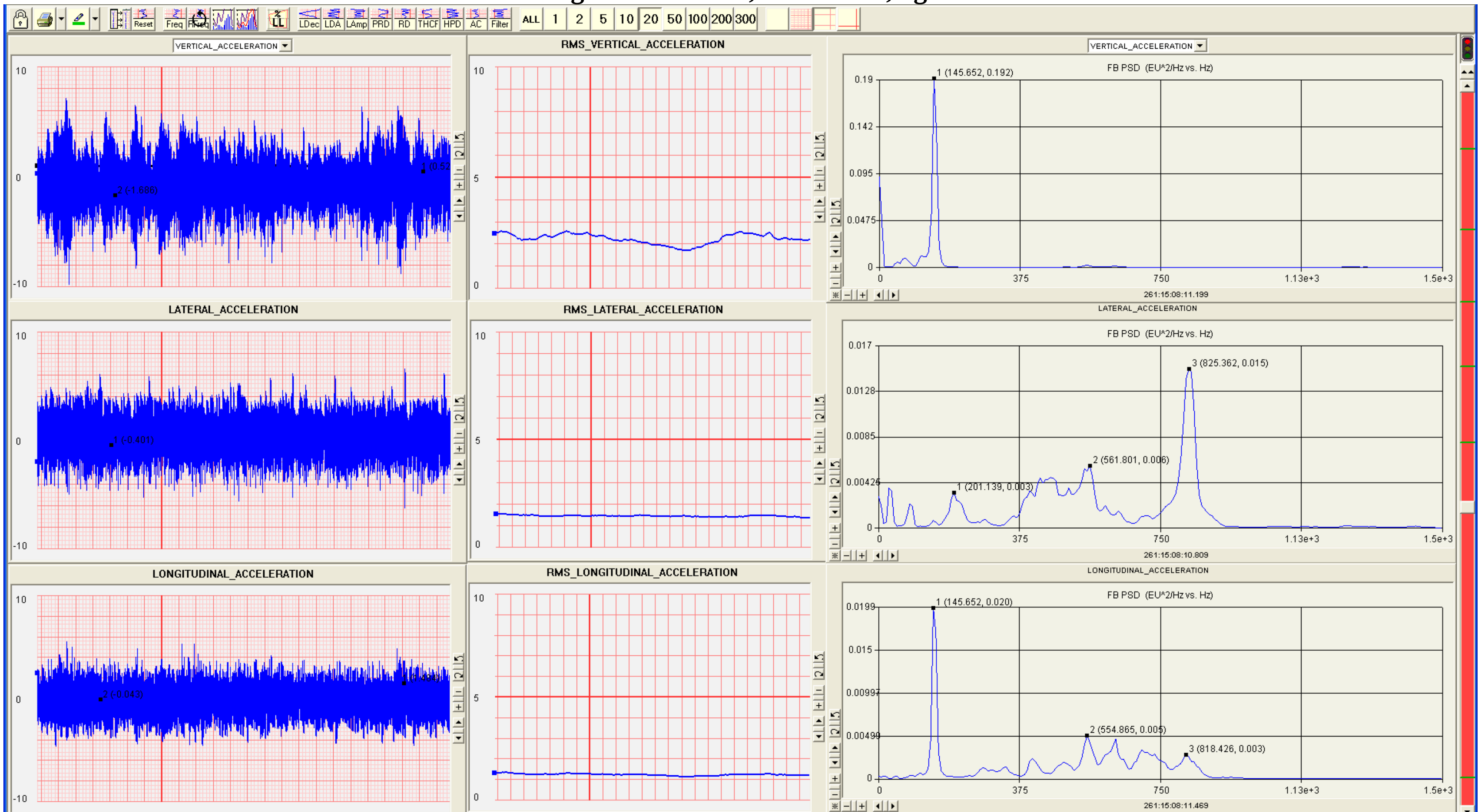
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A39: 15K, 0.94M, 6g



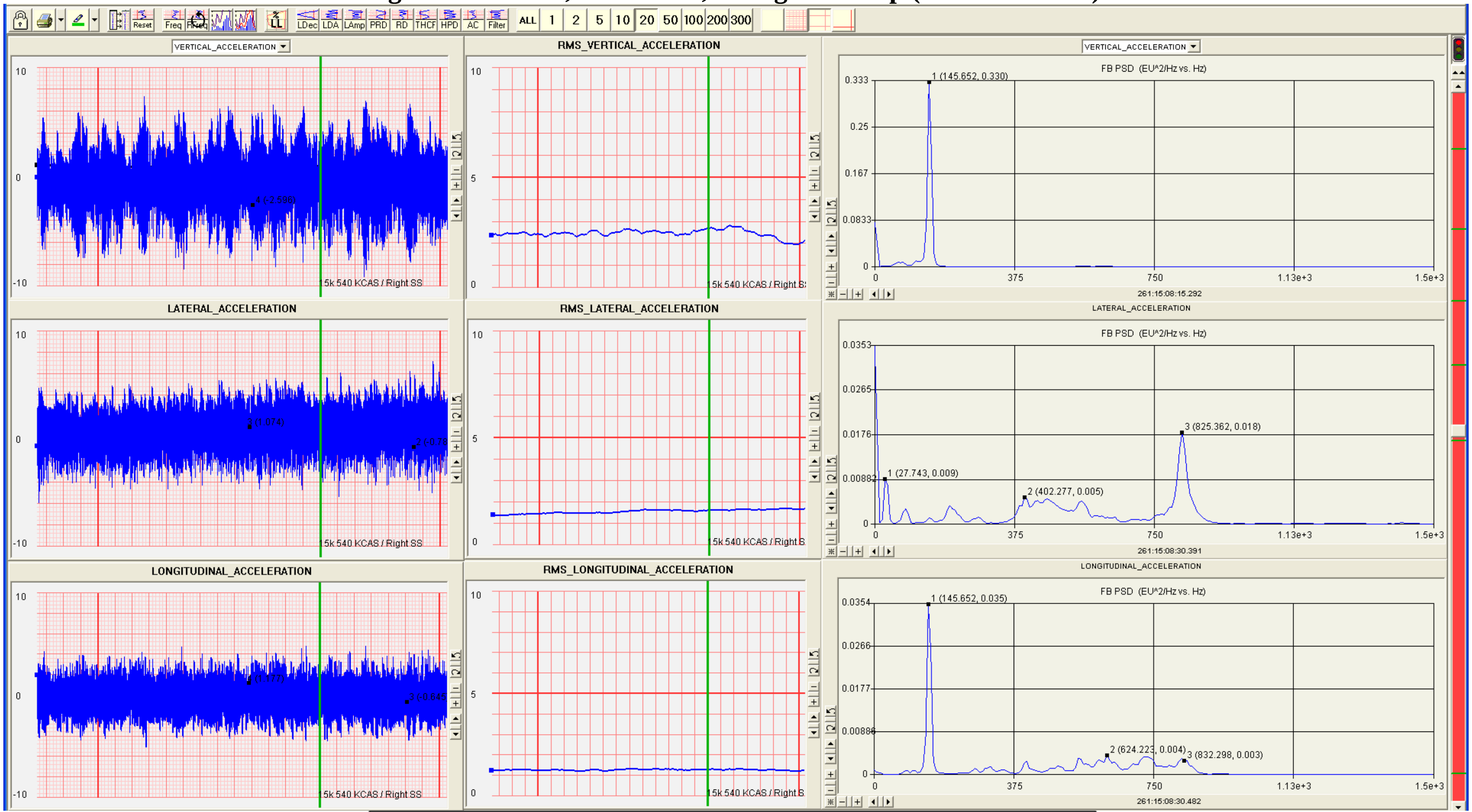
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A40: 15K, 530 KCAS, 1g



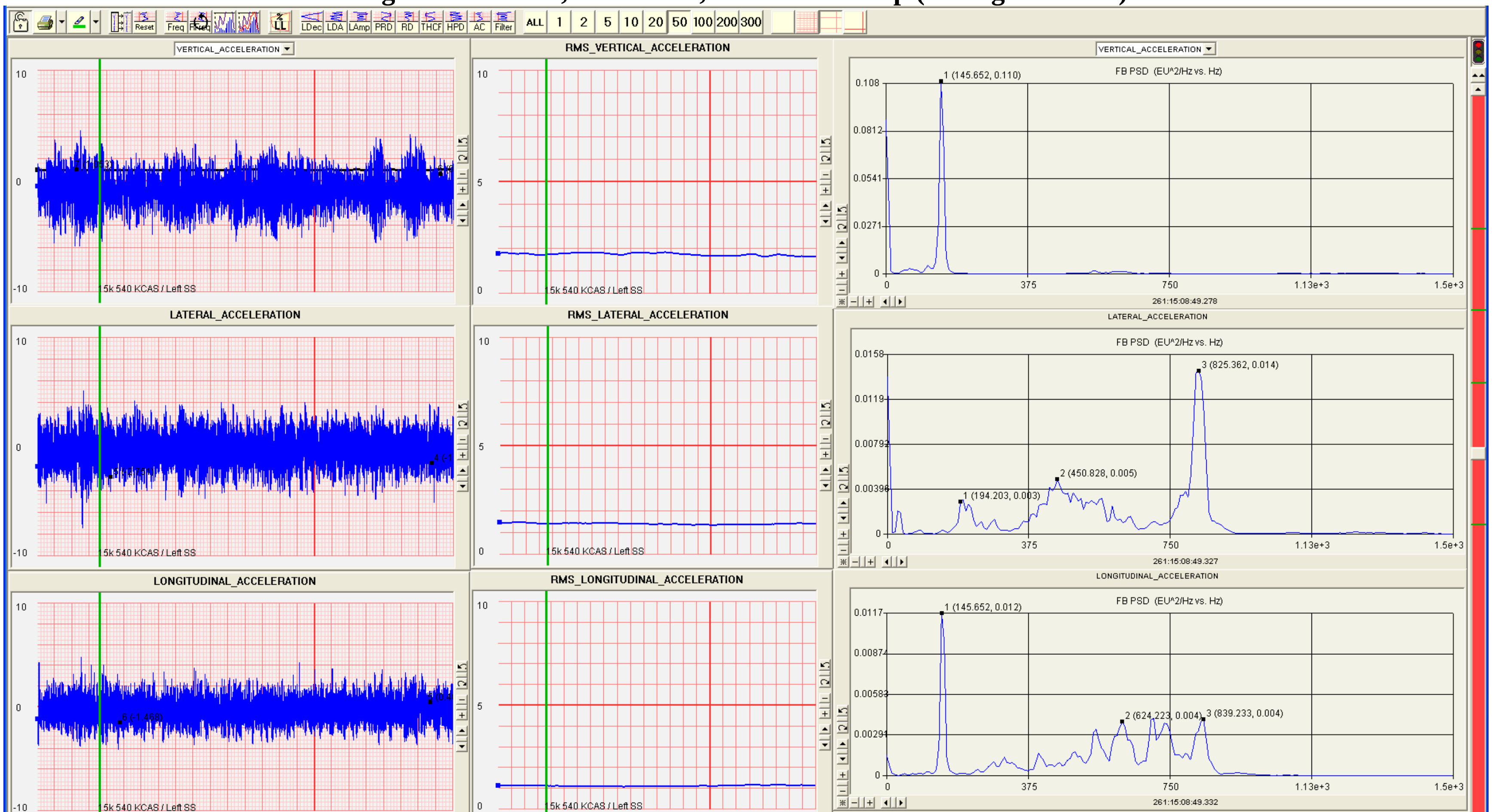
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A41: 15K, 530 KCAS, 3° Right sideslip (full left rudder)



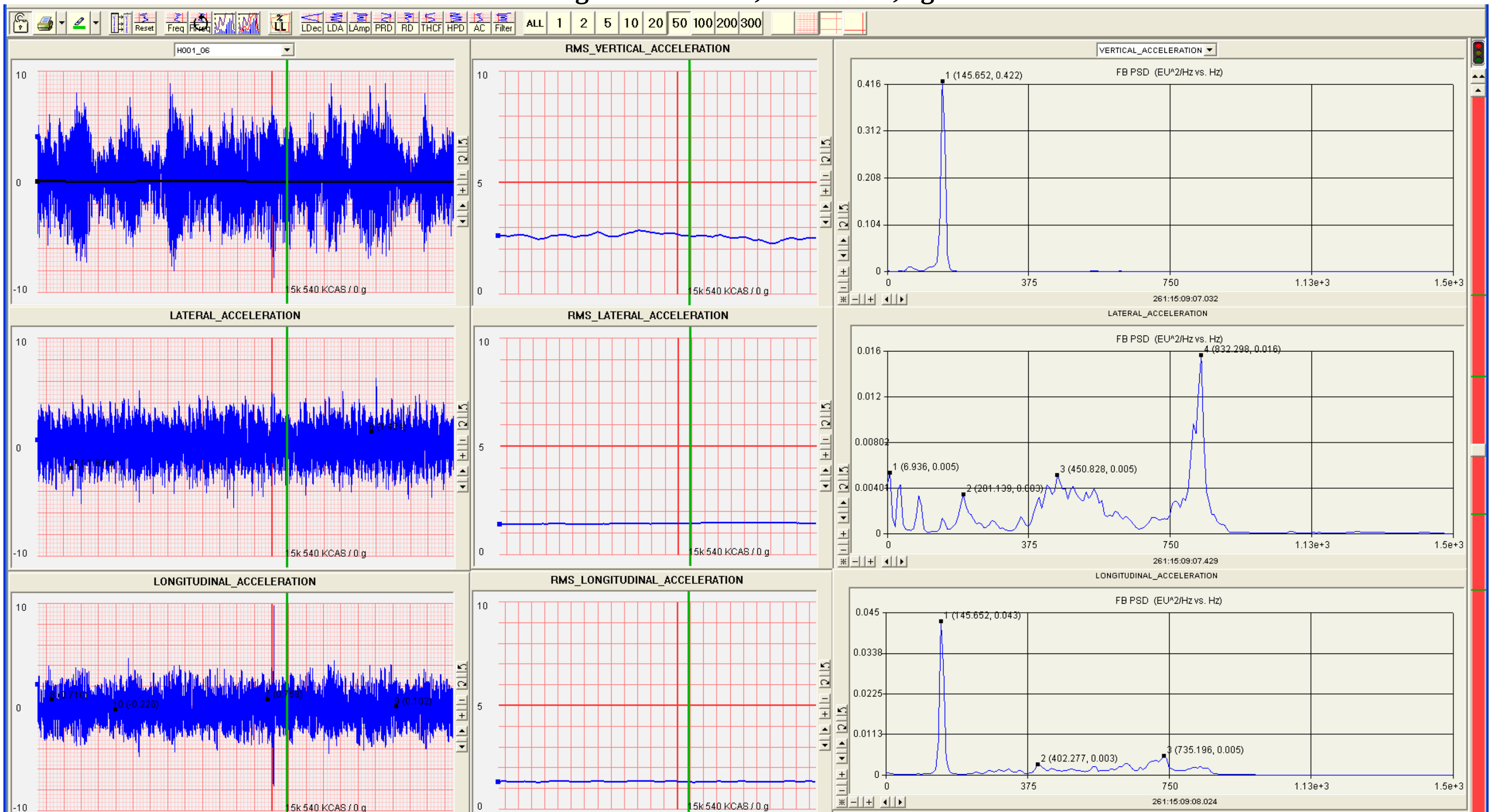
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A42: 15K, 530 KCAS, 3.4° Left sideslip (full right rudder)



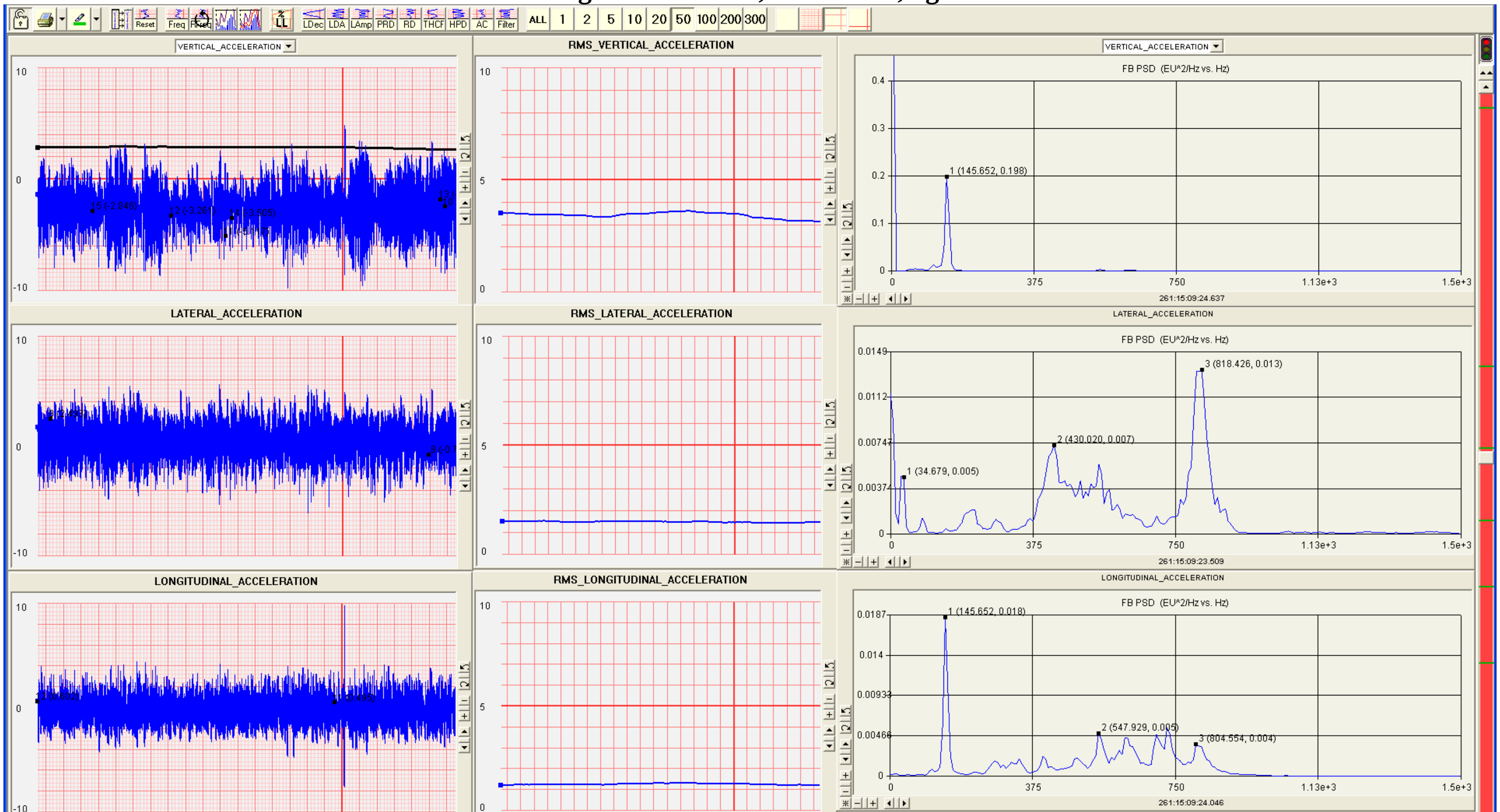
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A43: 15K, 530 KCAS, 0g



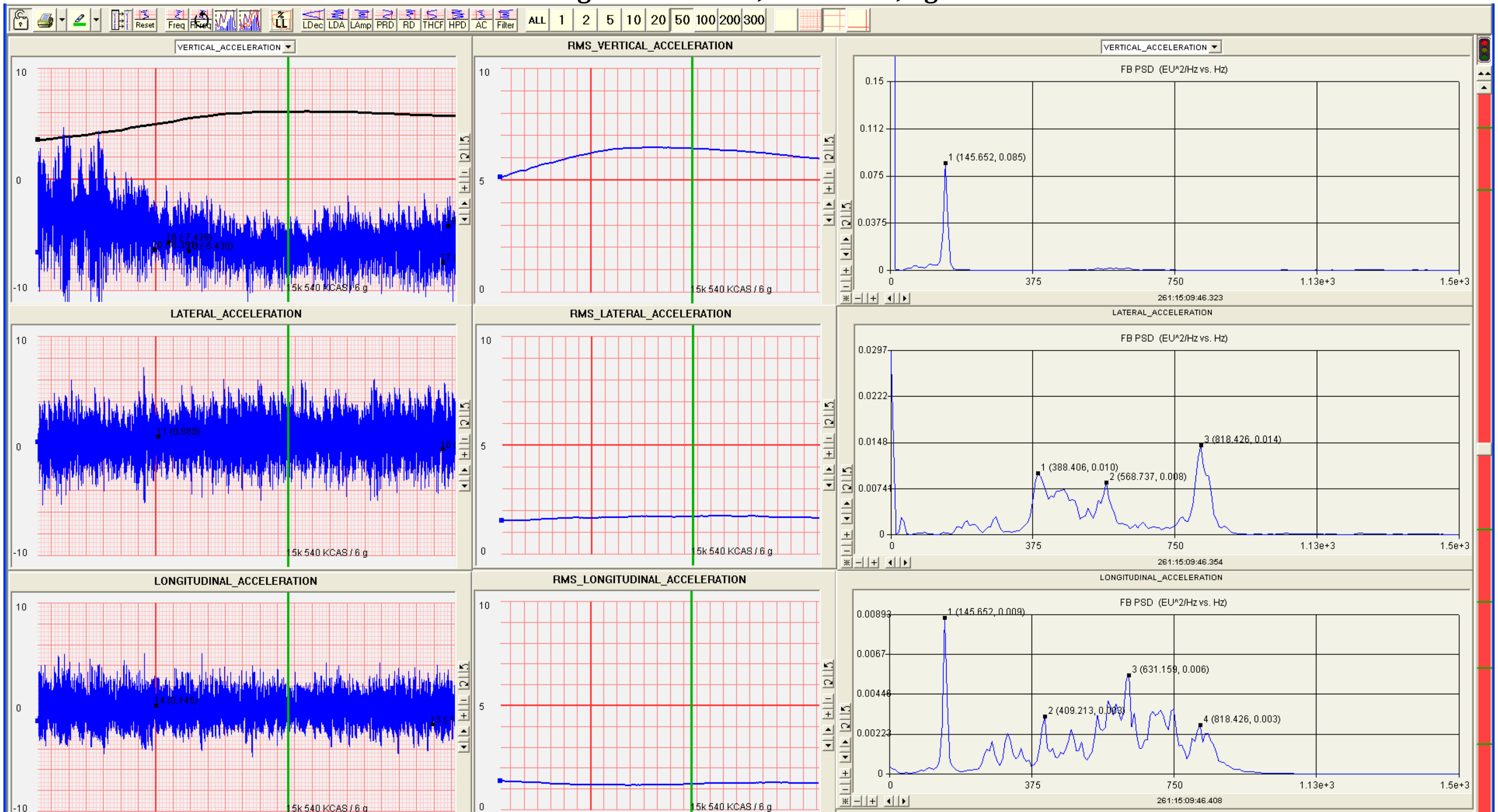
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A44: 15K, 530 KCAS, 3g



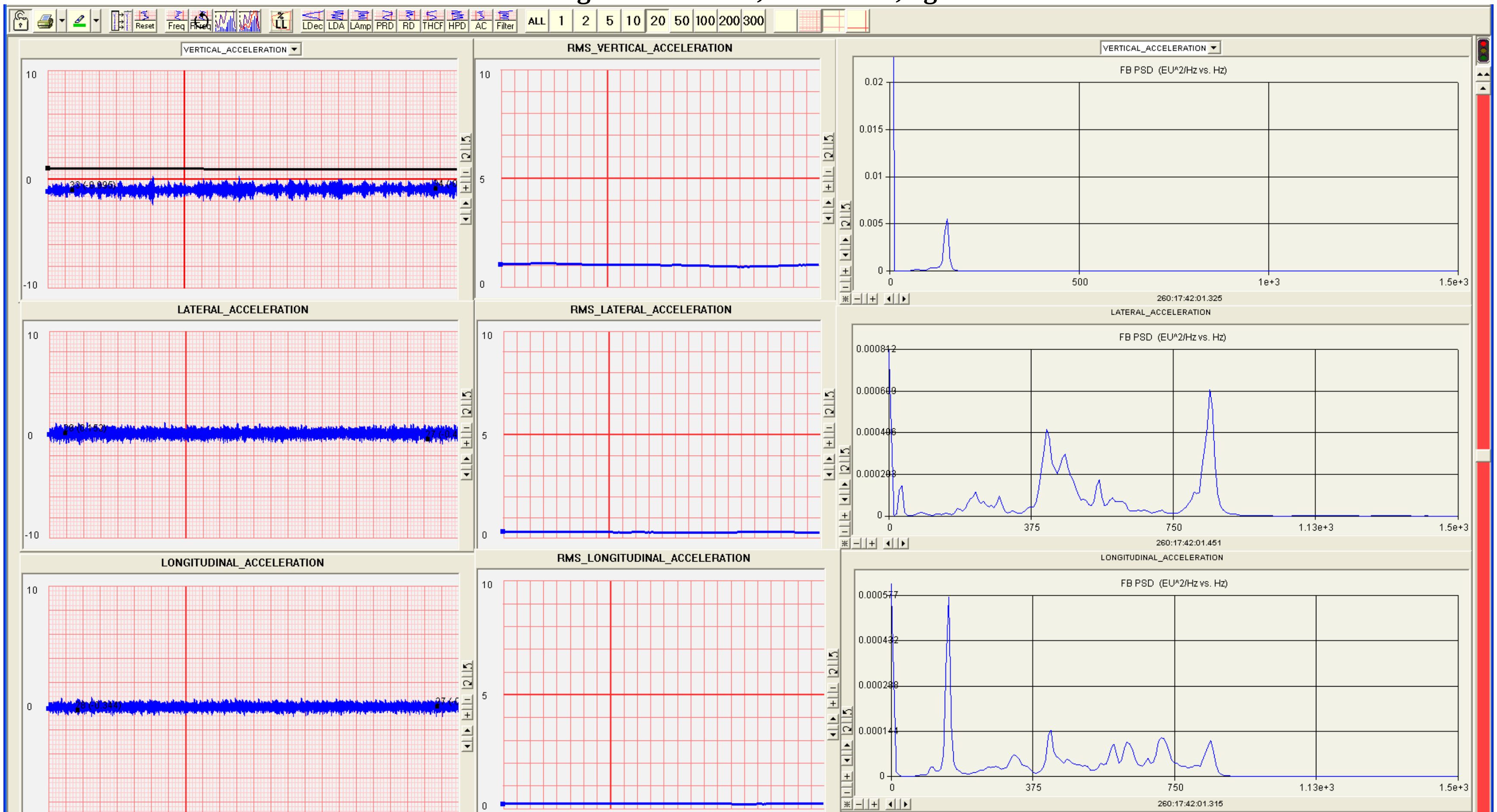
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A45: 15K, 530 KCAS, 6g



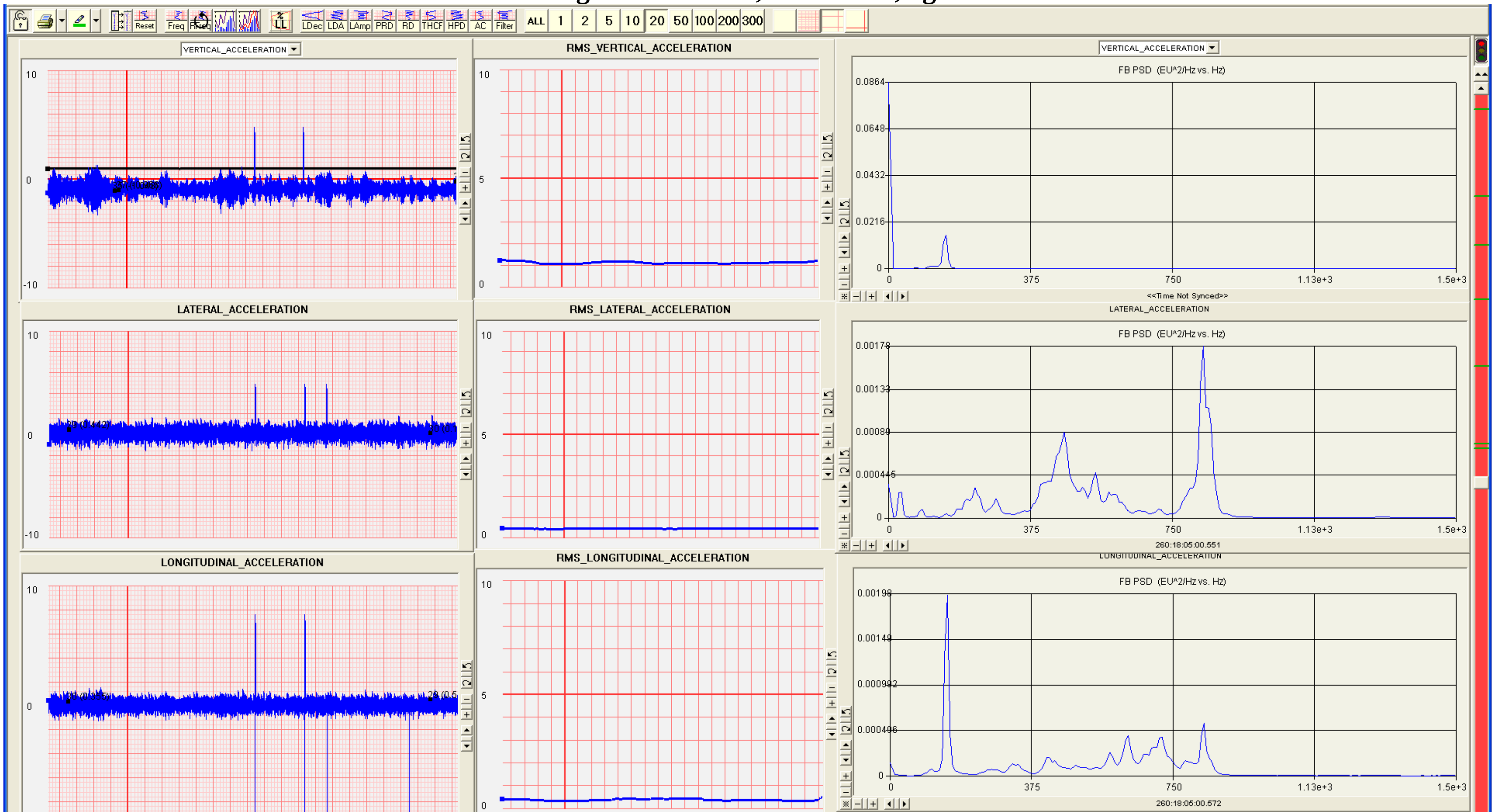
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A46: 25K, 250 KCAS, 1g



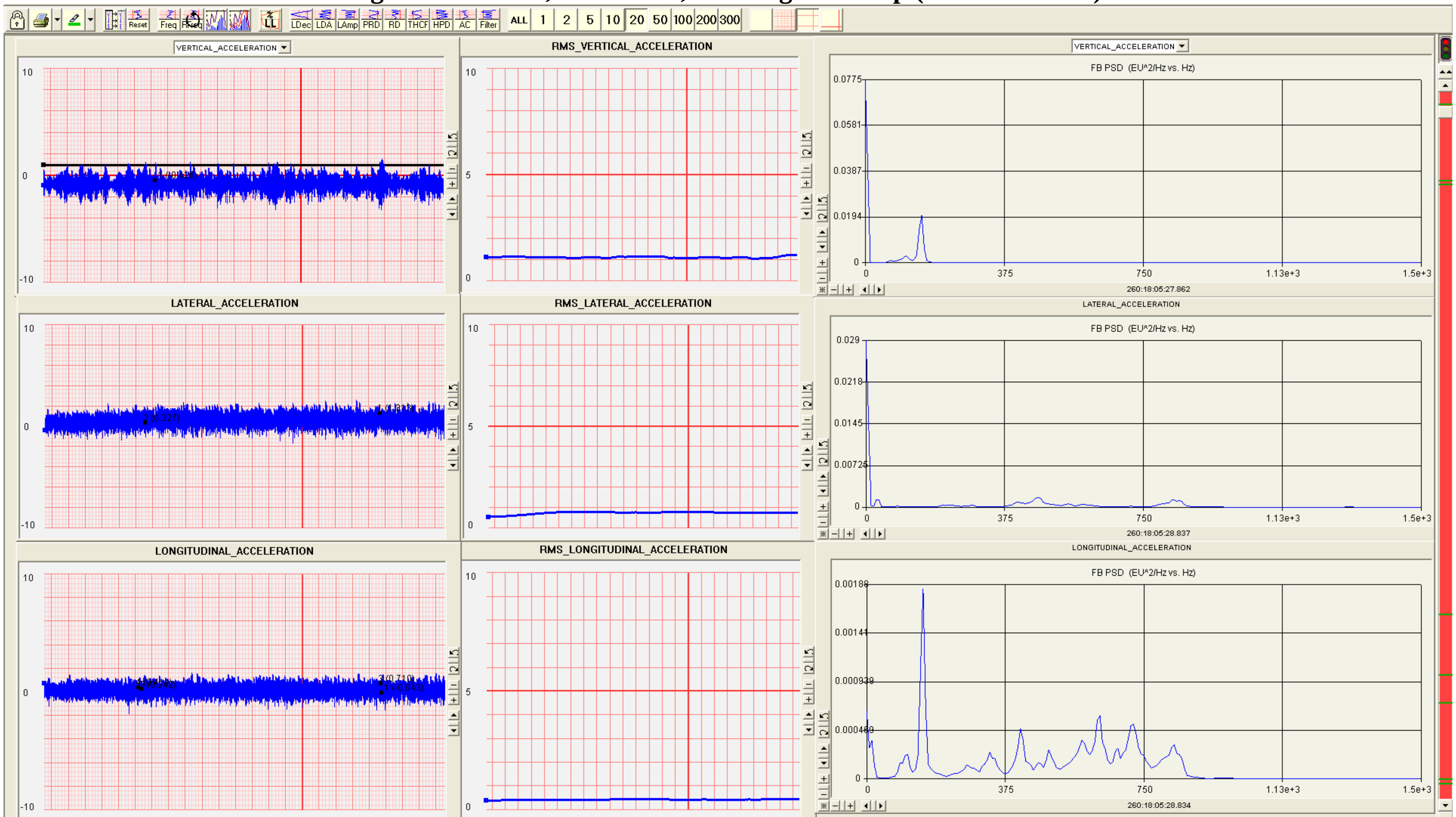
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A47: 25K, 312 KCAS, 1g



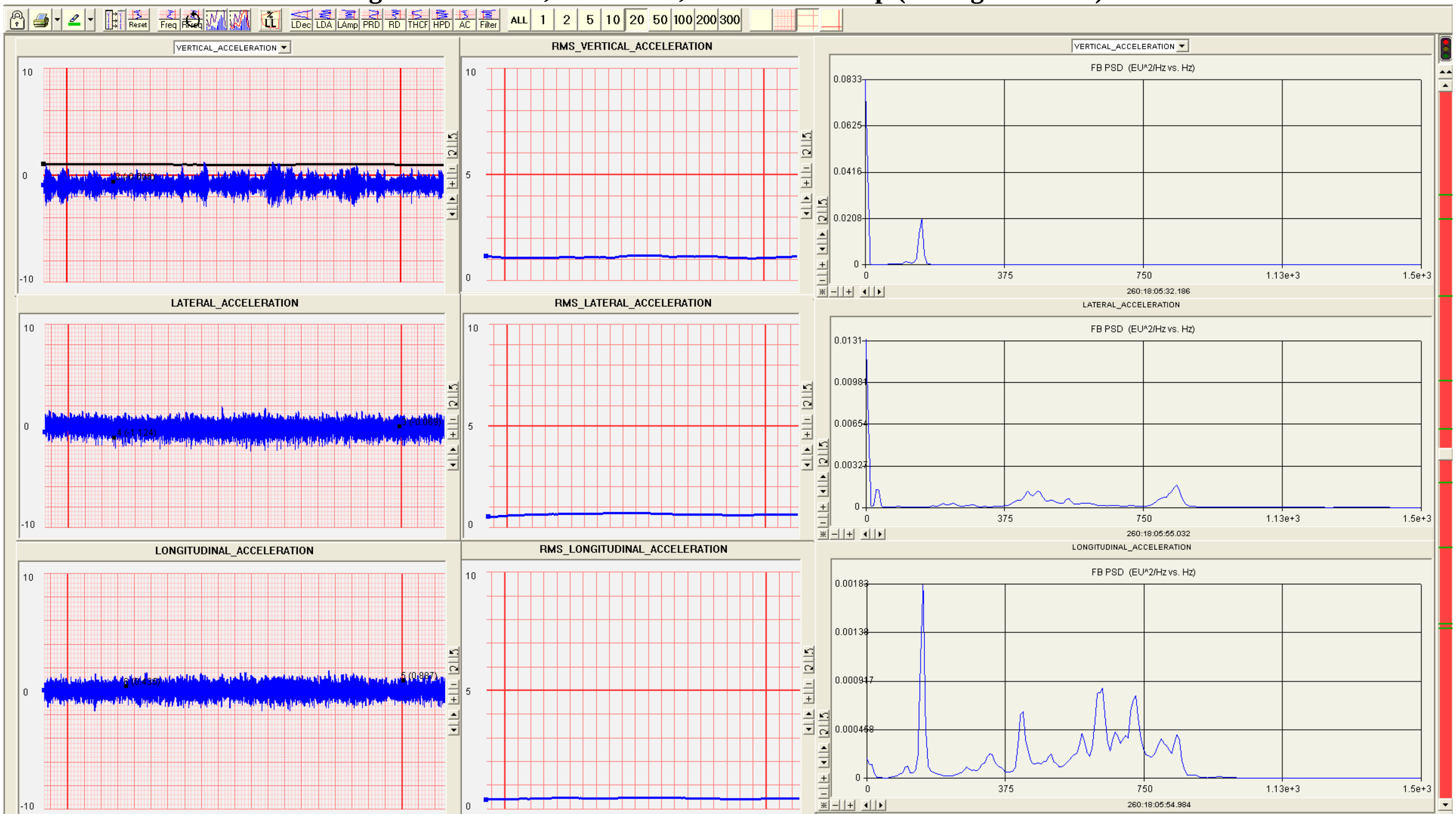
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A48: 25K, 312 KCAS, 7.7 ° Right sideslip (full left rudder)



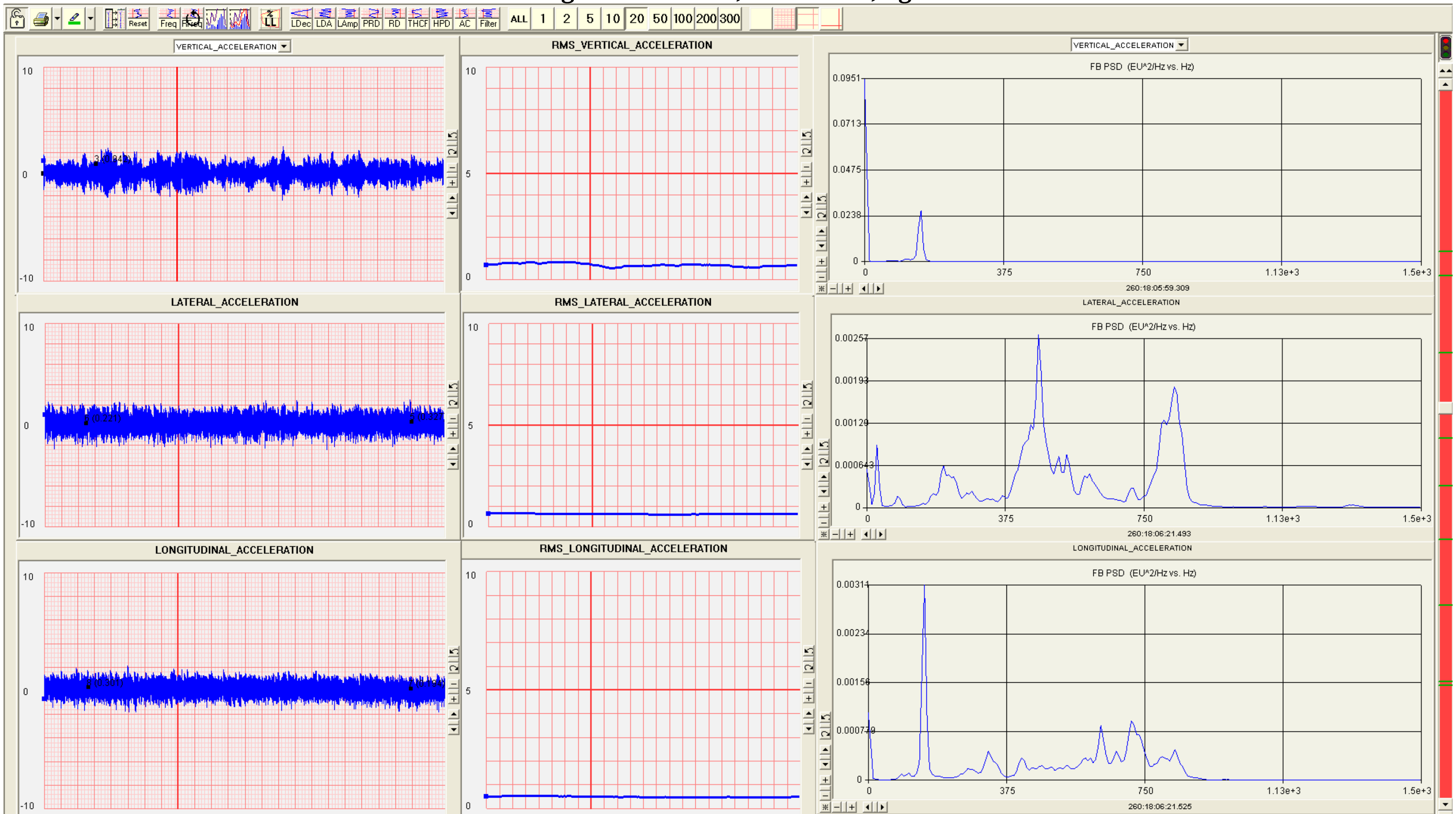
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A49: 25K, 312 KCAS, 8.5 ° Left sideslip (full right rudder)



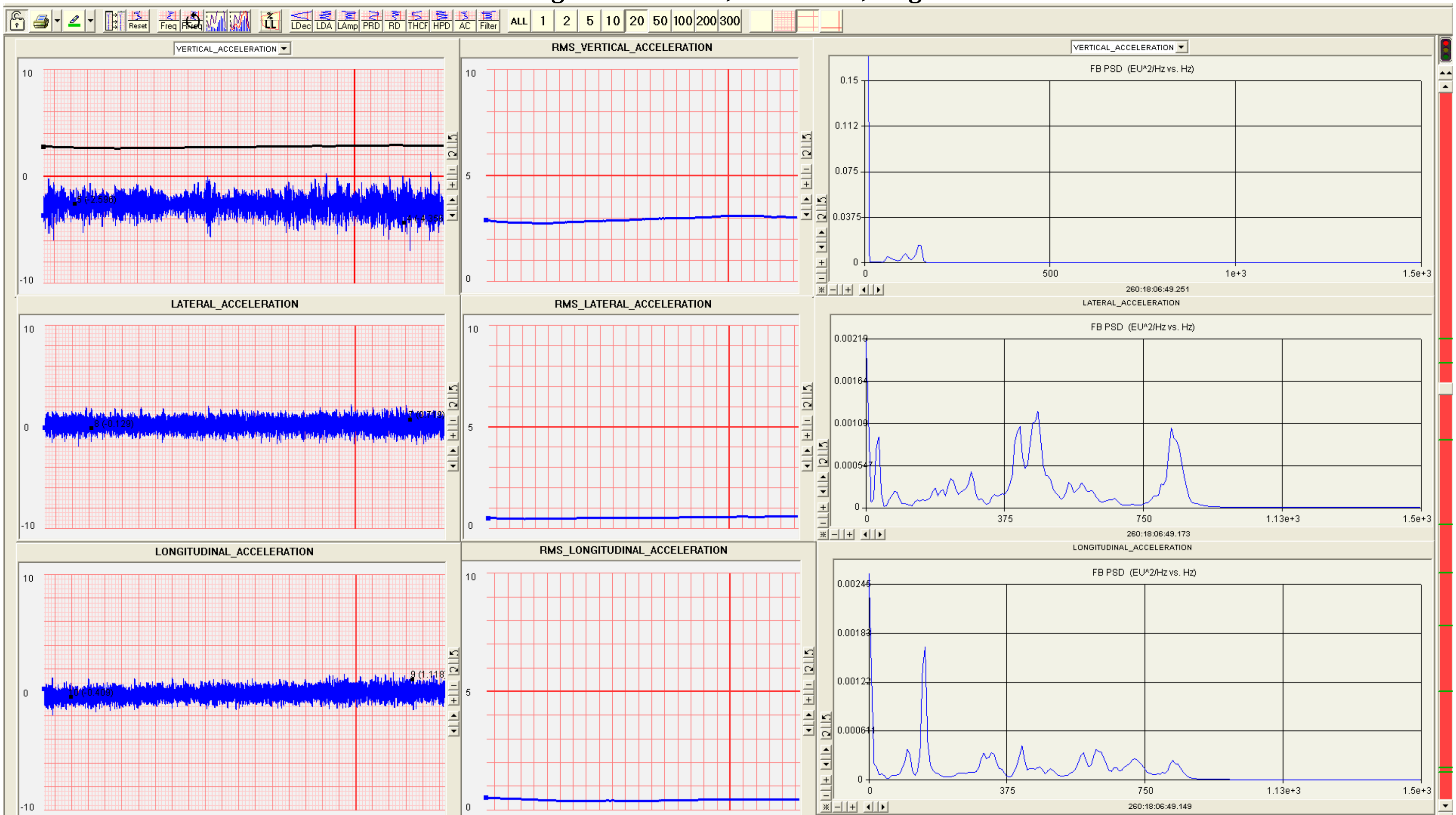
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A50: 25K, 312 KCAS, 0g



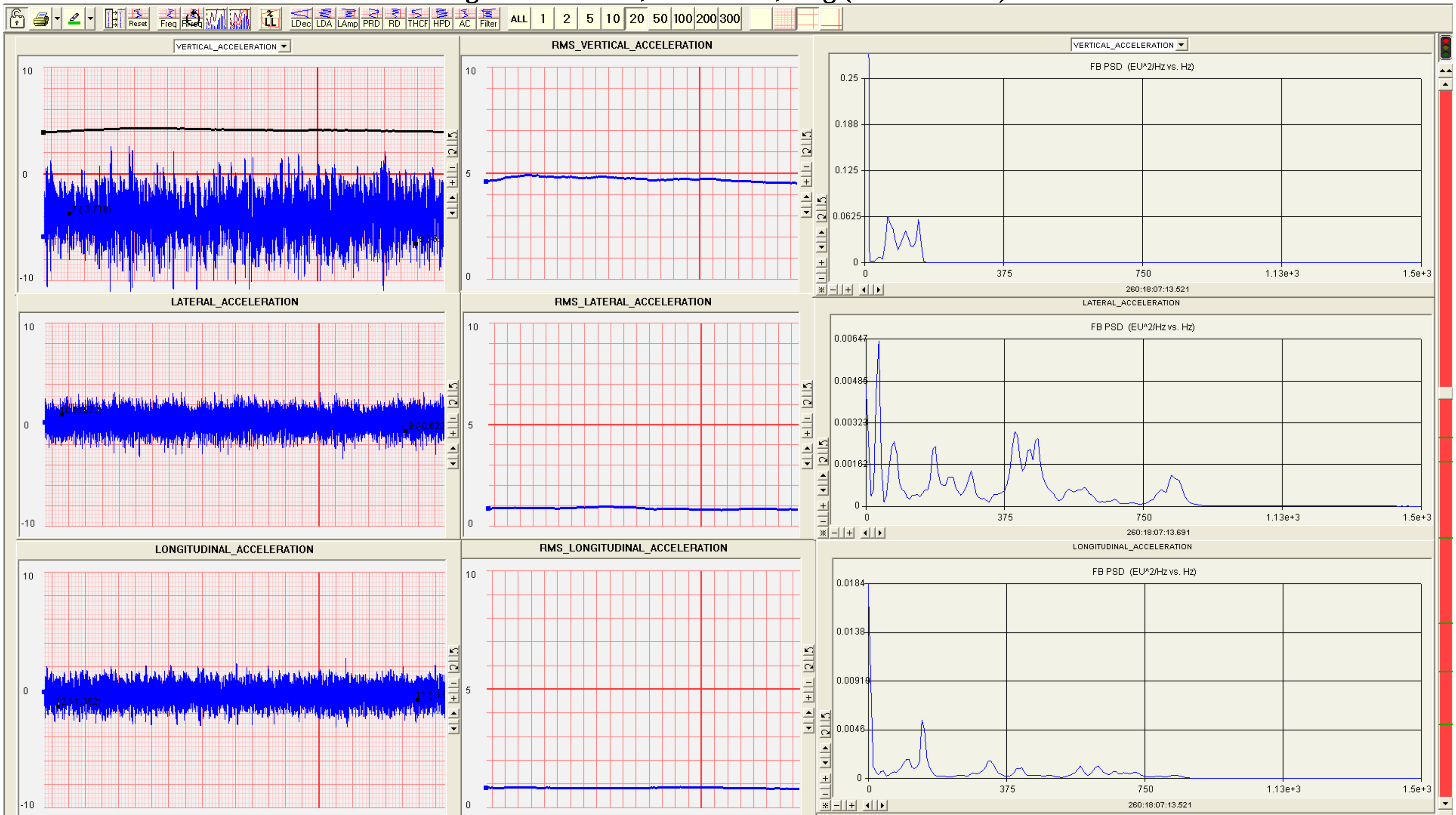
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A51: 25K, 312 KCAS, 2.9g



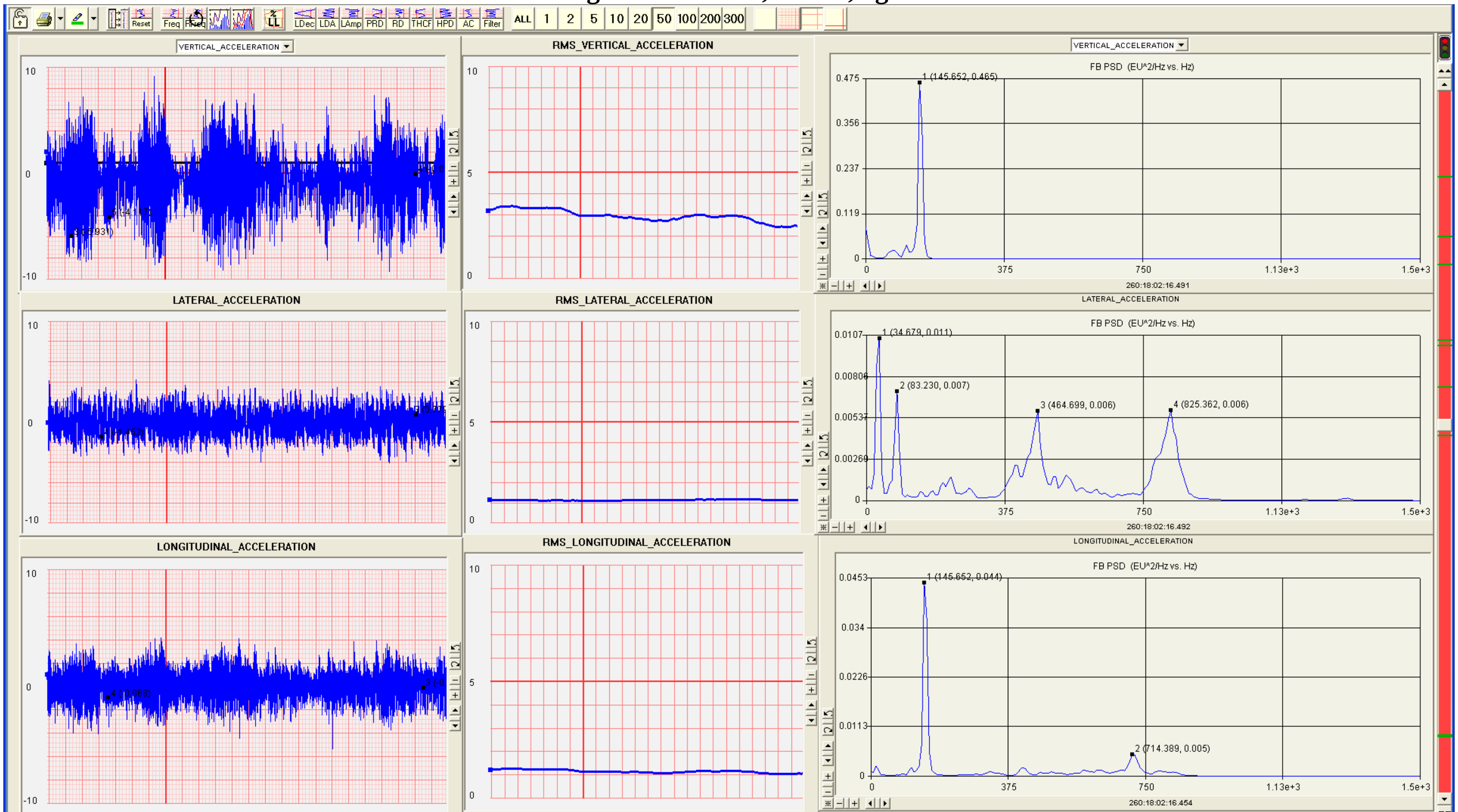
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A52: 25K, 312 KCAS, 4.3g (AOA limited)



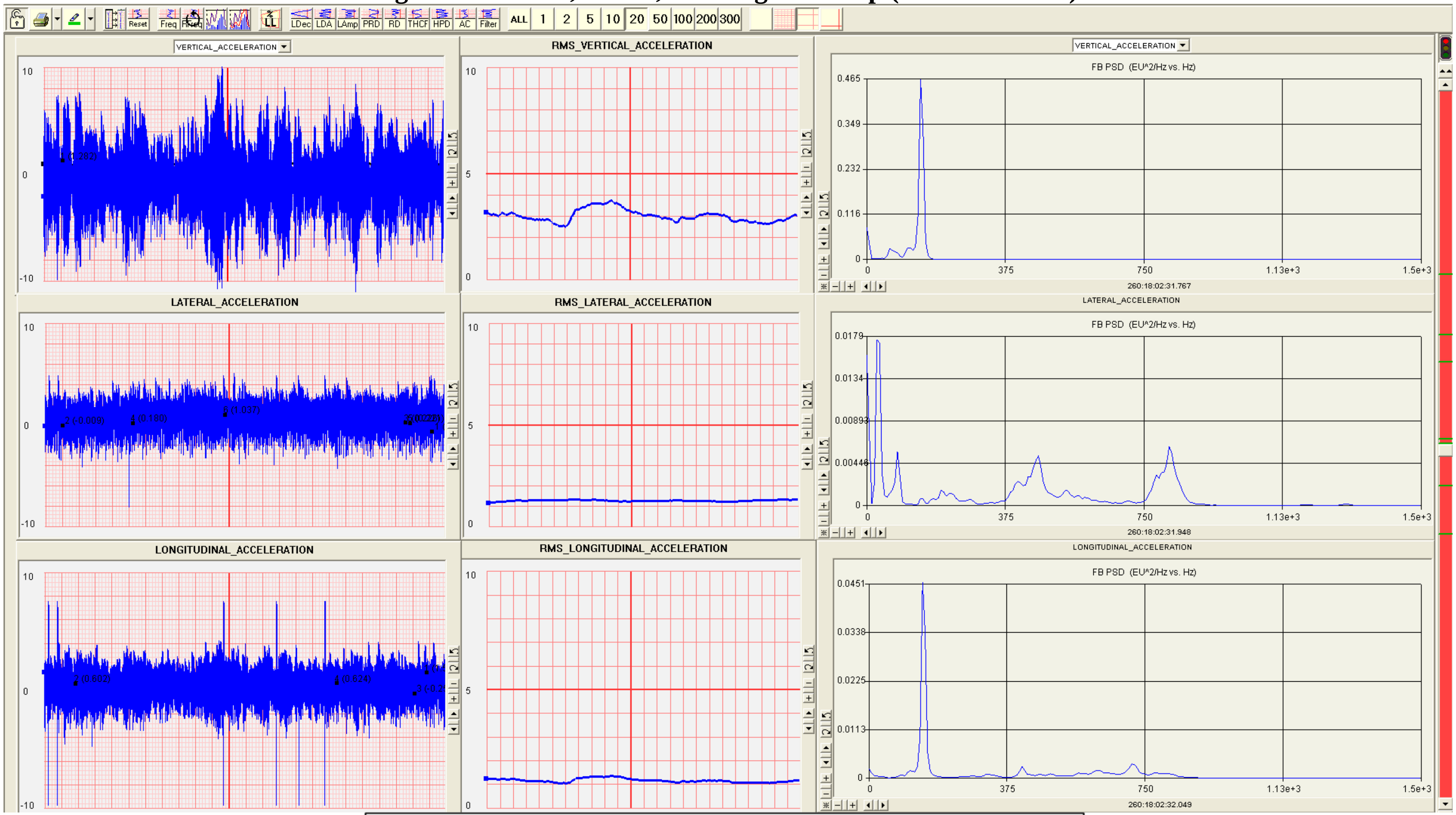
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A53: 25K, 0.94M, 1g



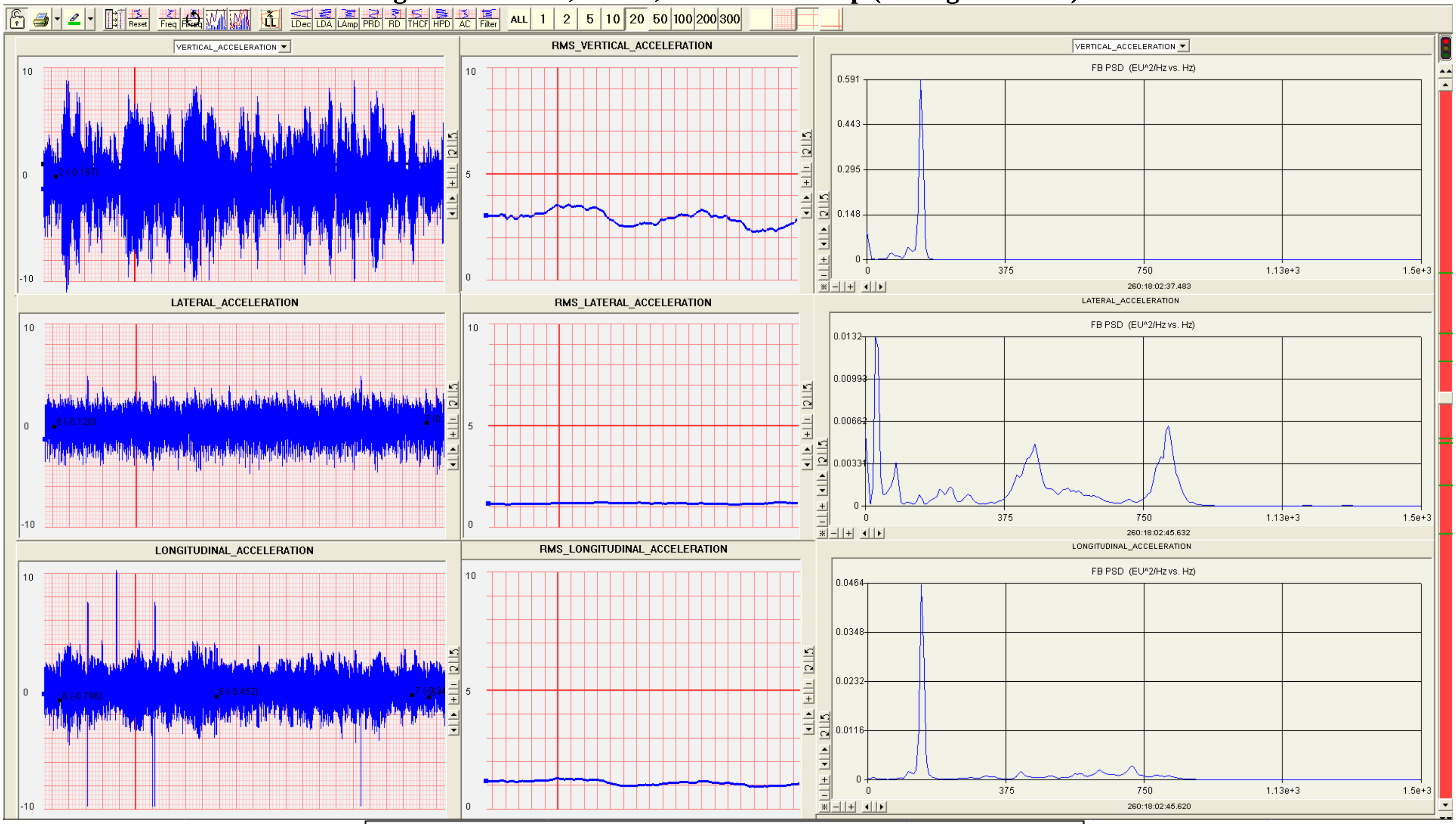
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A54: 25K, 0.94M, 3.5 ° Right sideslip (full left rudder)



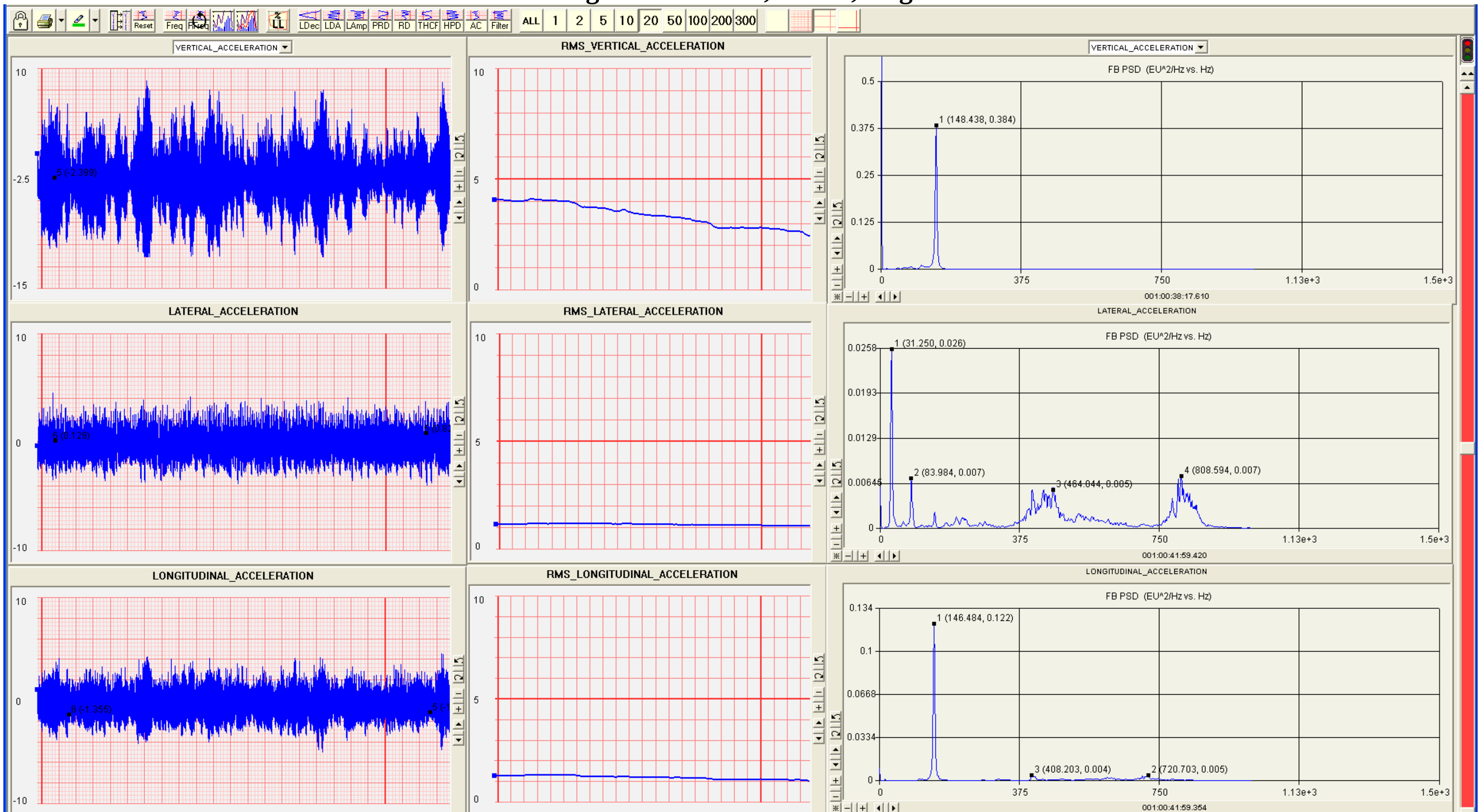
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A55: 25K, 0.94M, 4.2 ° Left sideslip (full right rudder)



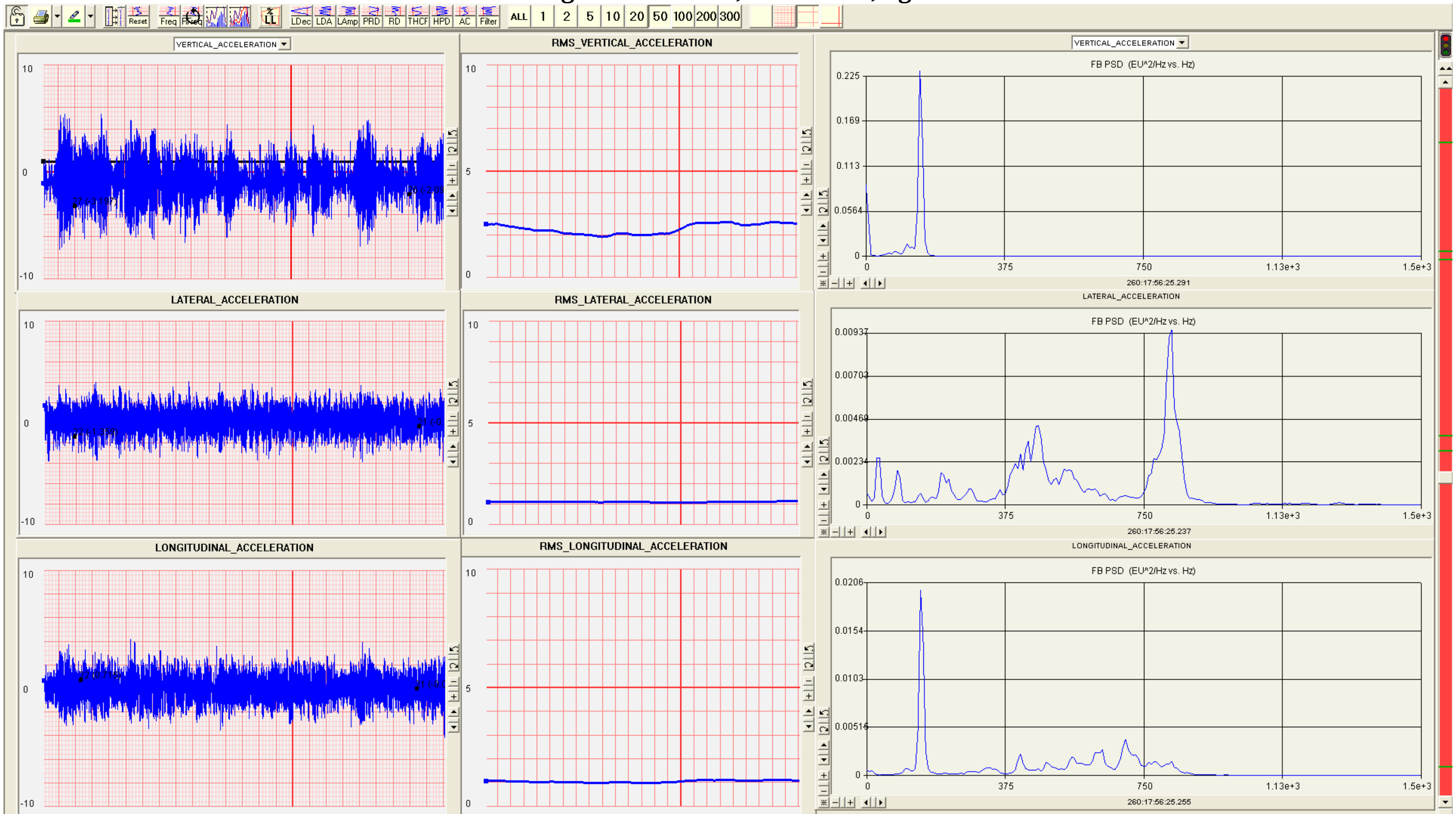
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A56: 25K, 0.94M, 2.4g



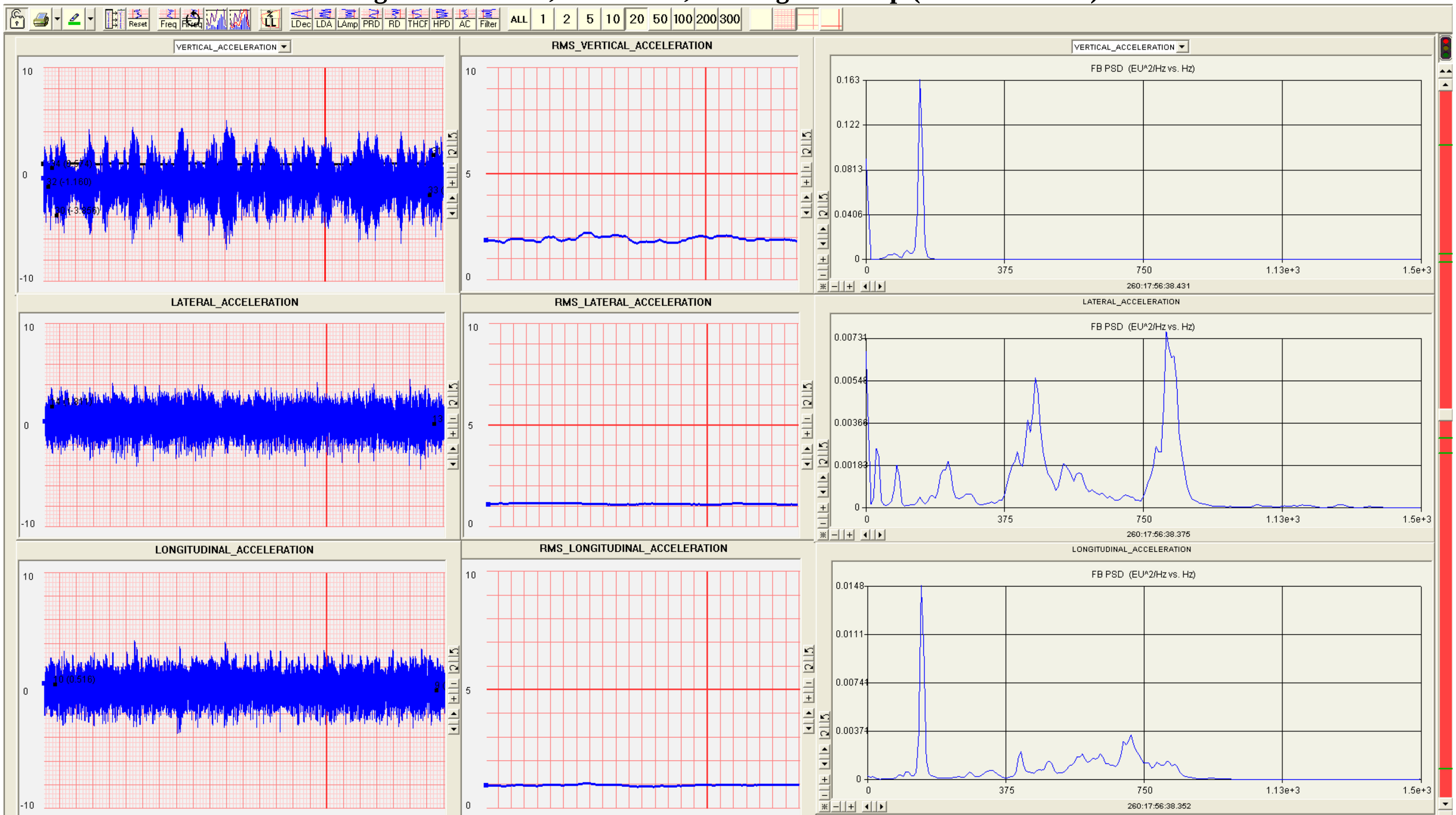
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A57: 25K, 428 KCAS, 1g



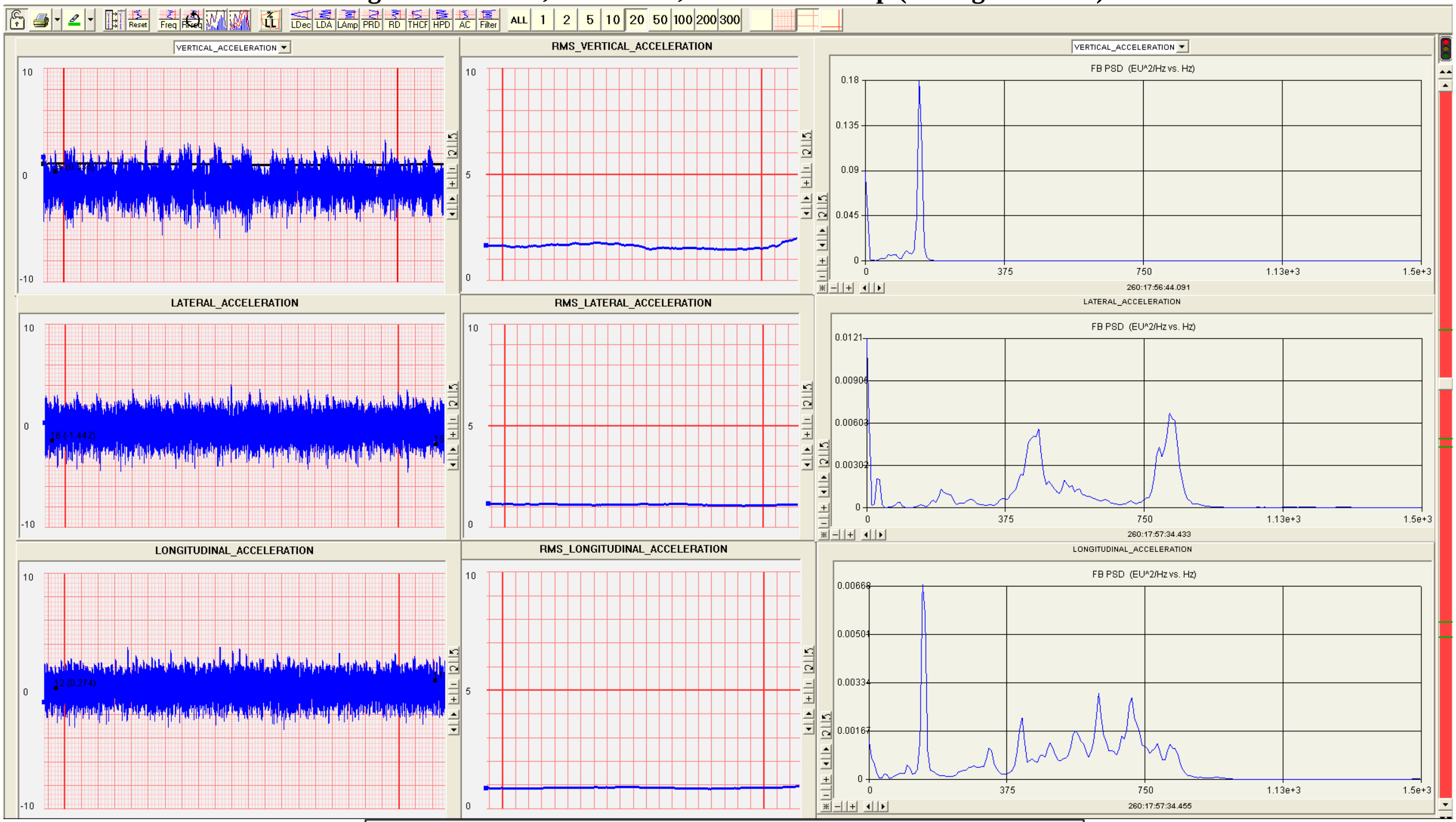
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A58: 25K, 428 KCAS, 5.2° Right sideslip (full left rudder)



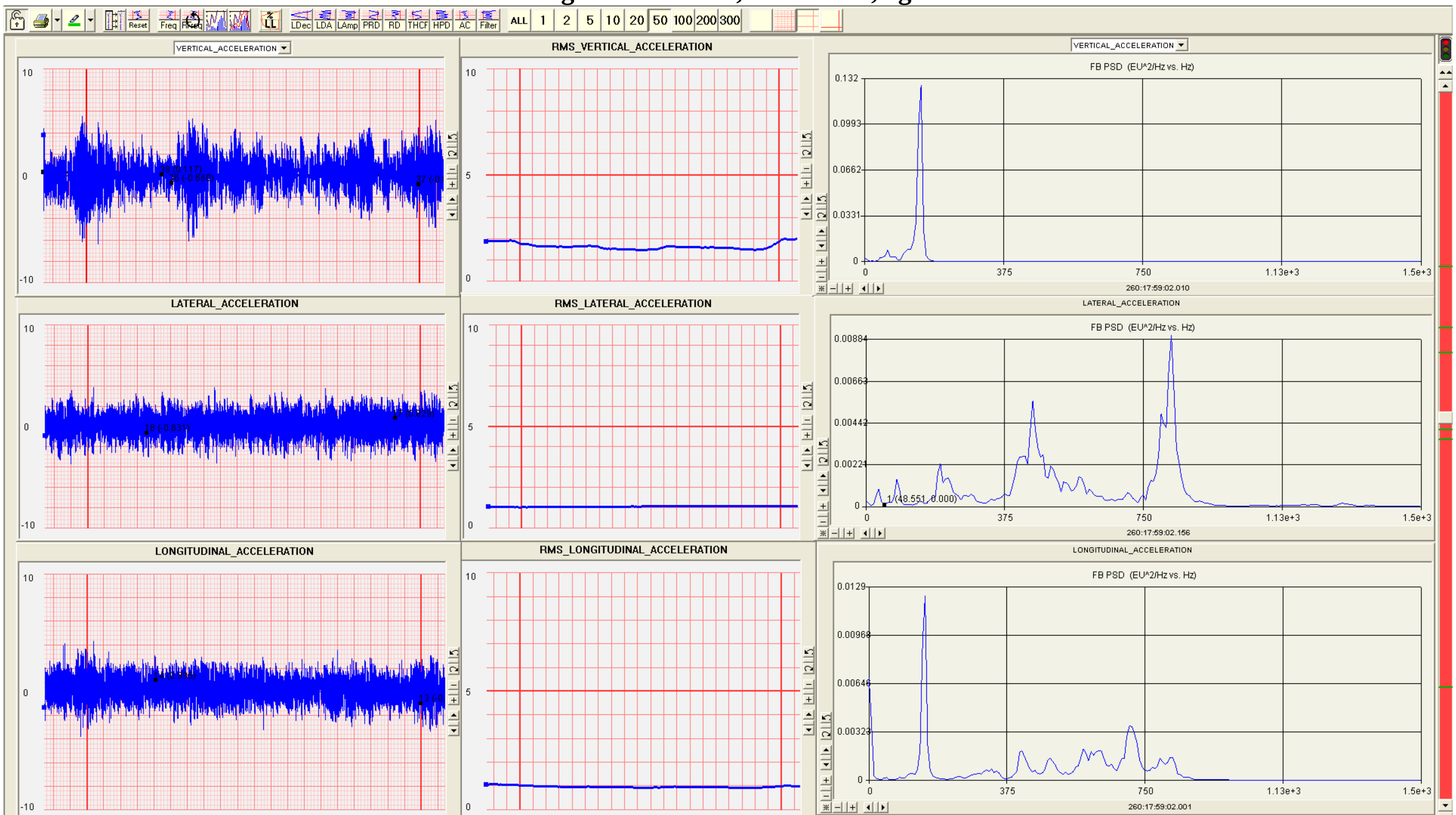
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A59: 25K, 428 KCAS, -6.1° Left sideslip (full right rudder)



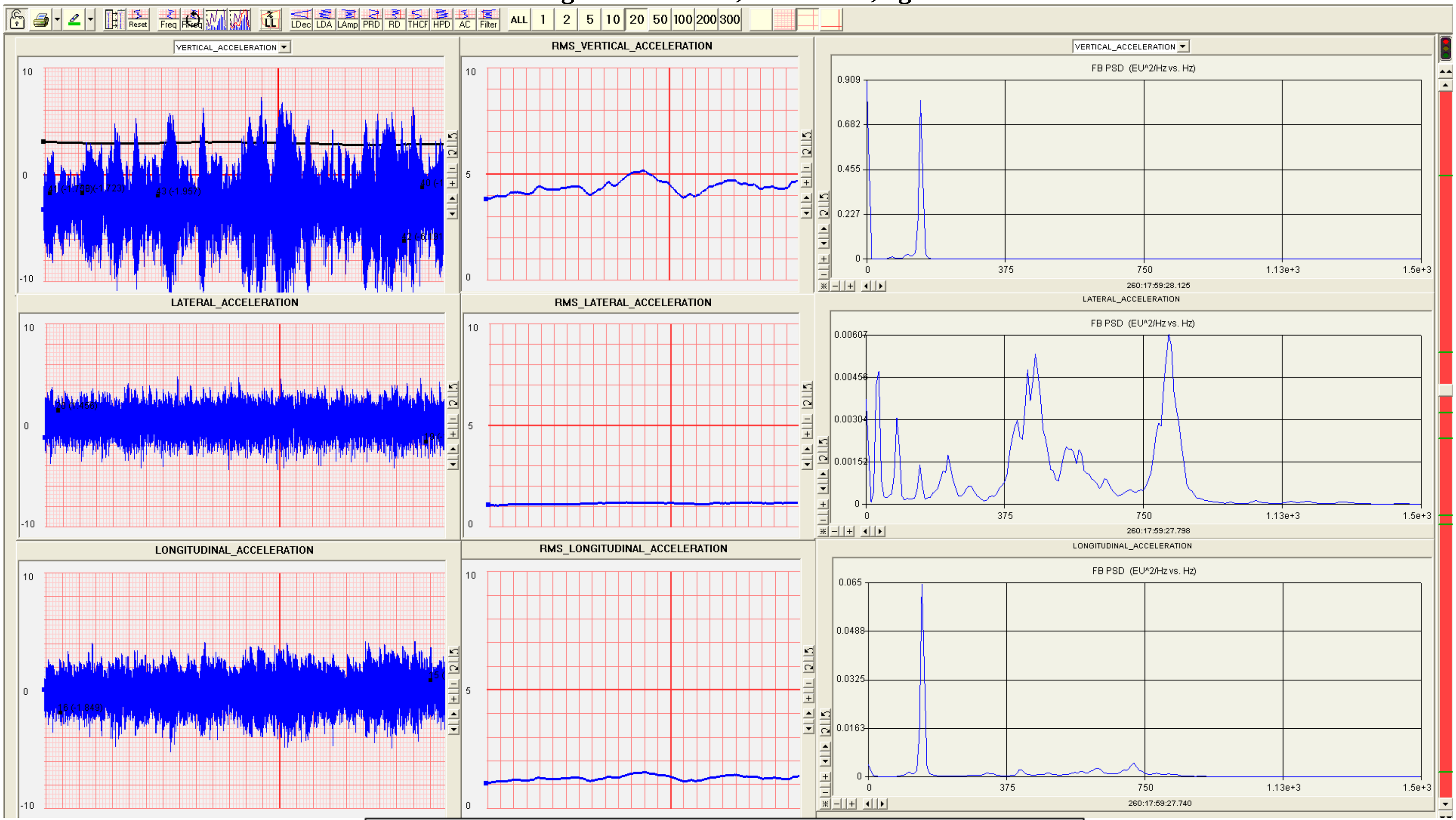
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A60: 25K, 428 KCAS, 0g



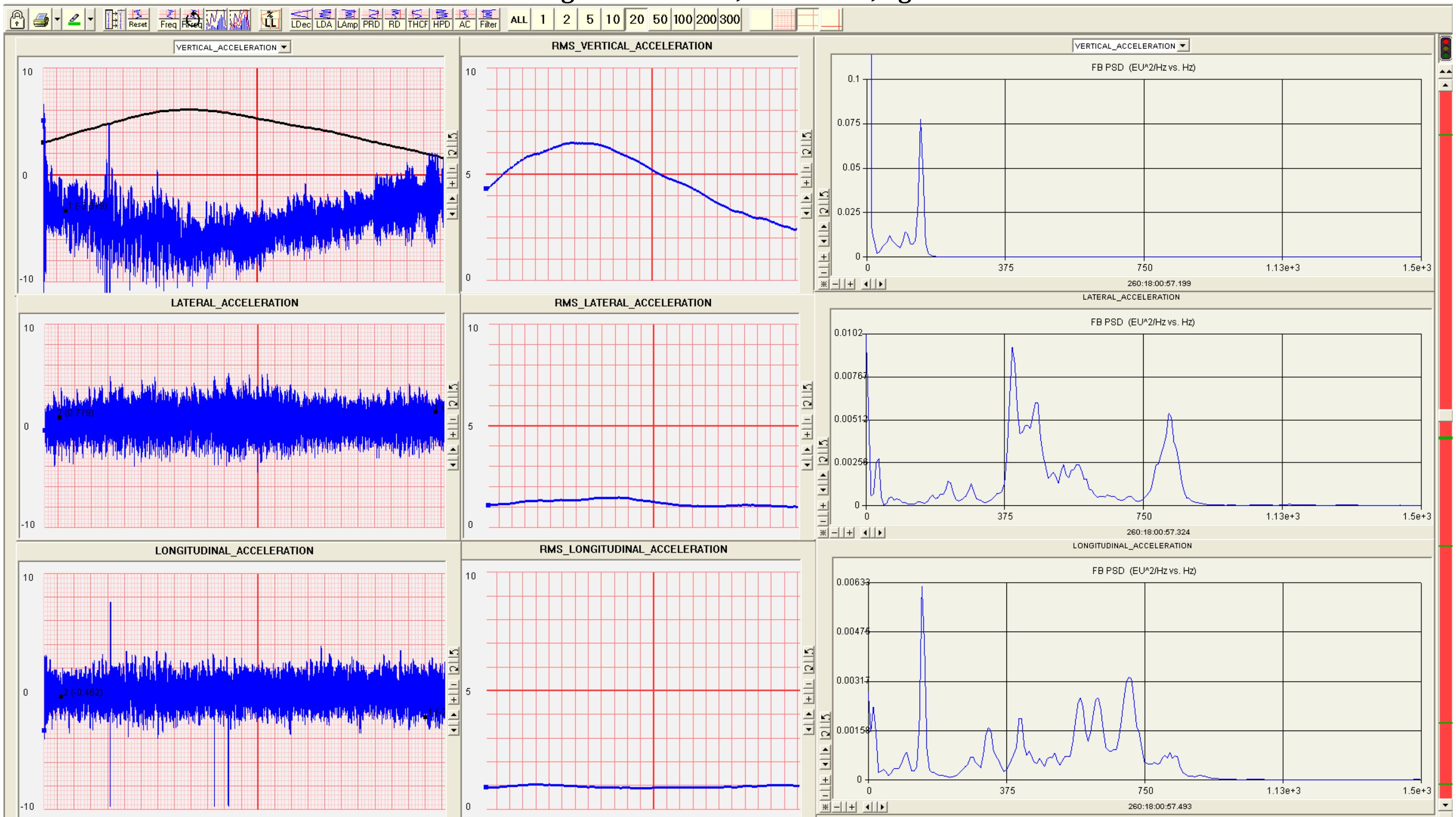
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A61: 25K, 428 KCAS, 3g



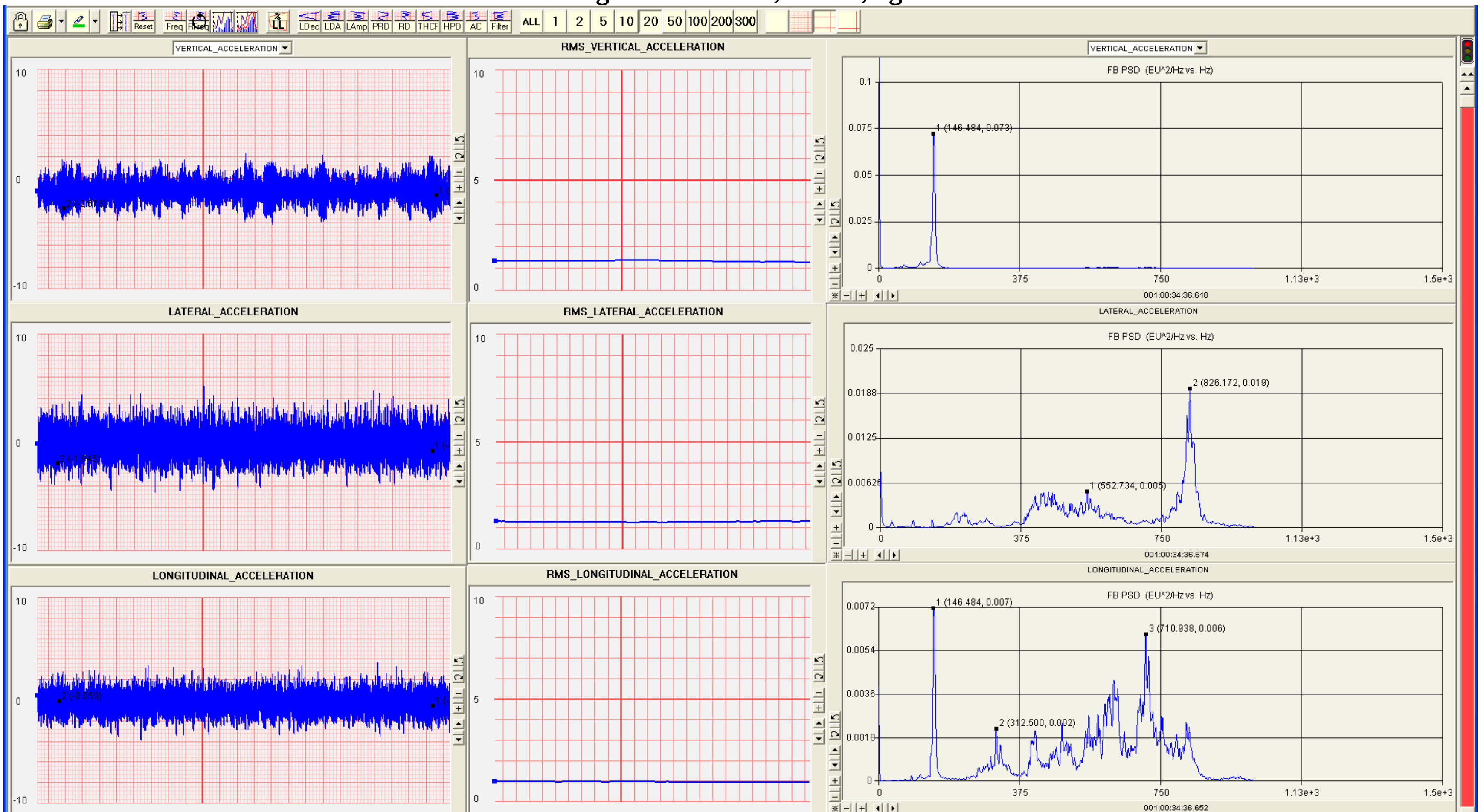
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A62: 25K, 428 KCAS, 6g



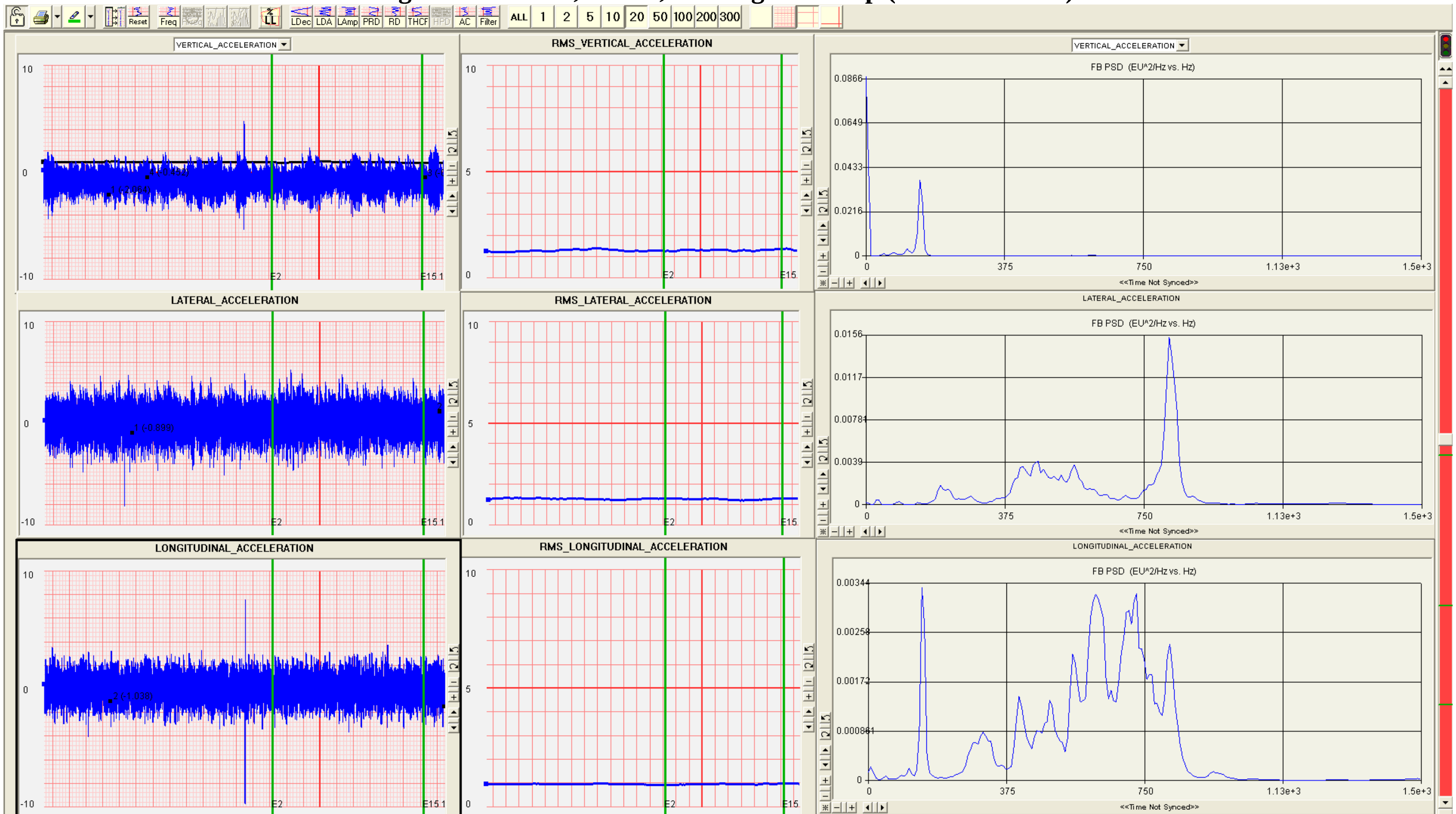
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A63: 25K, 1.17M, 1g



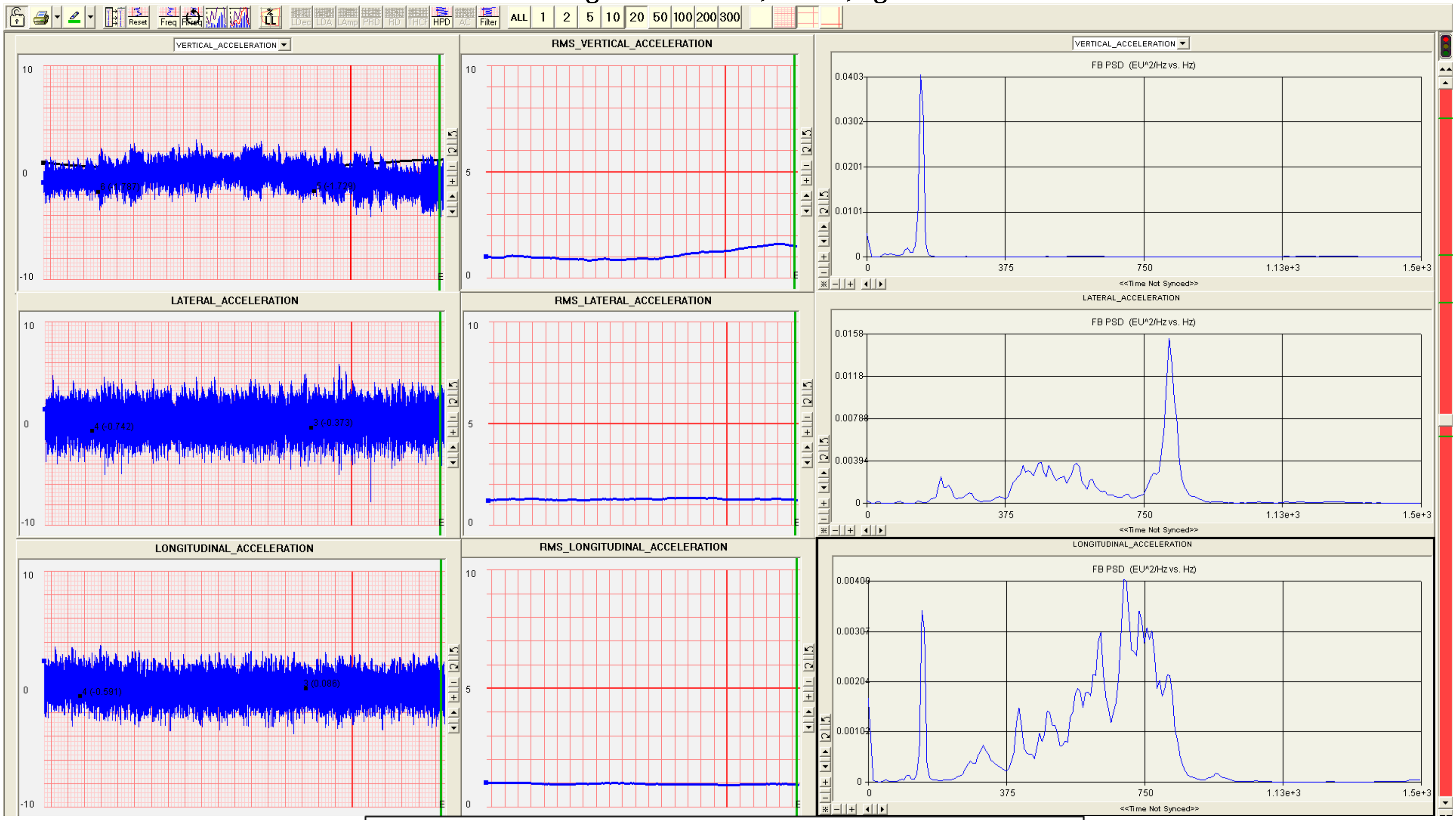
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A64: 25K, 1.17M, 2.8° Right sideslip (full left rudder)



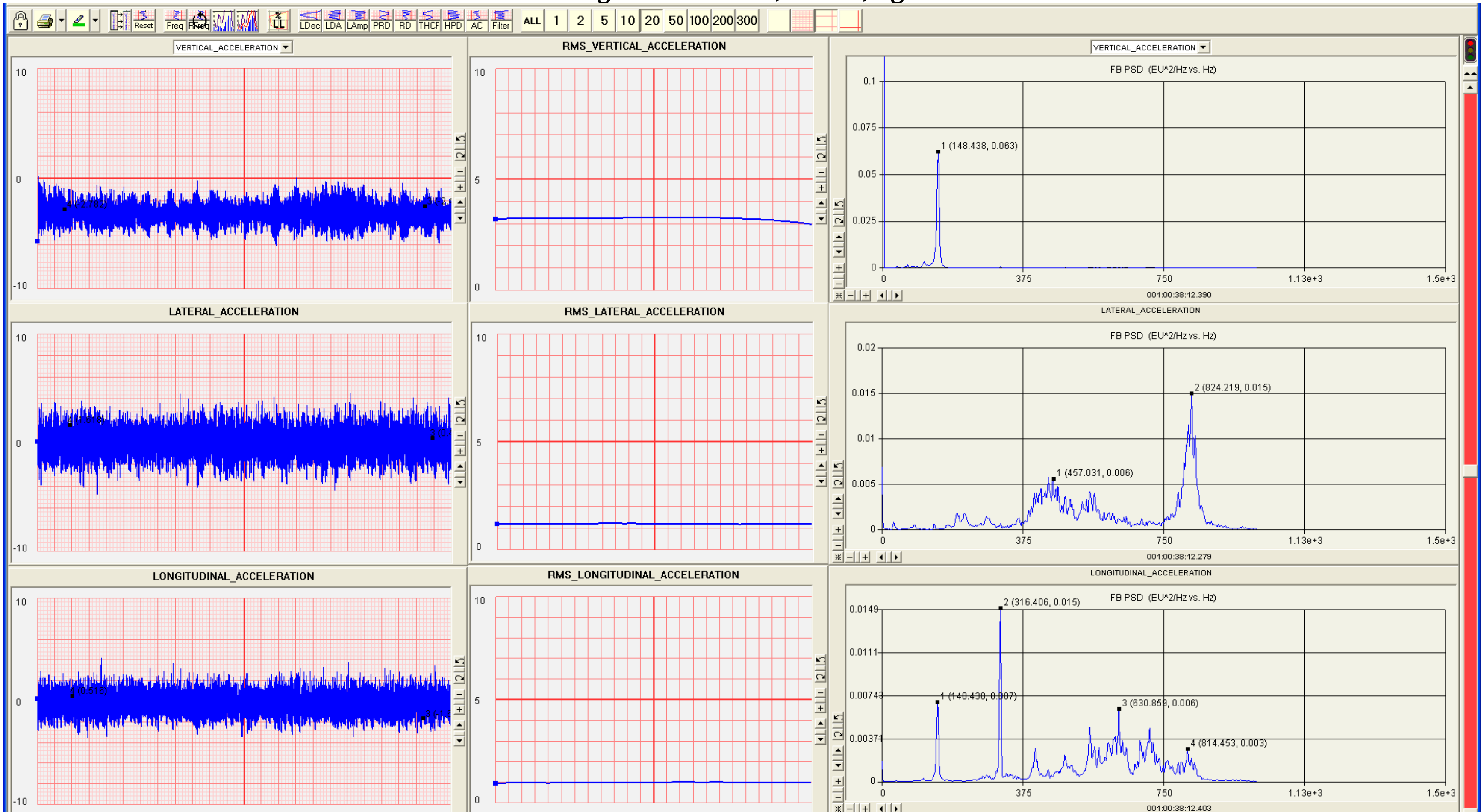
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A65: 25K, 1.17M, 0g



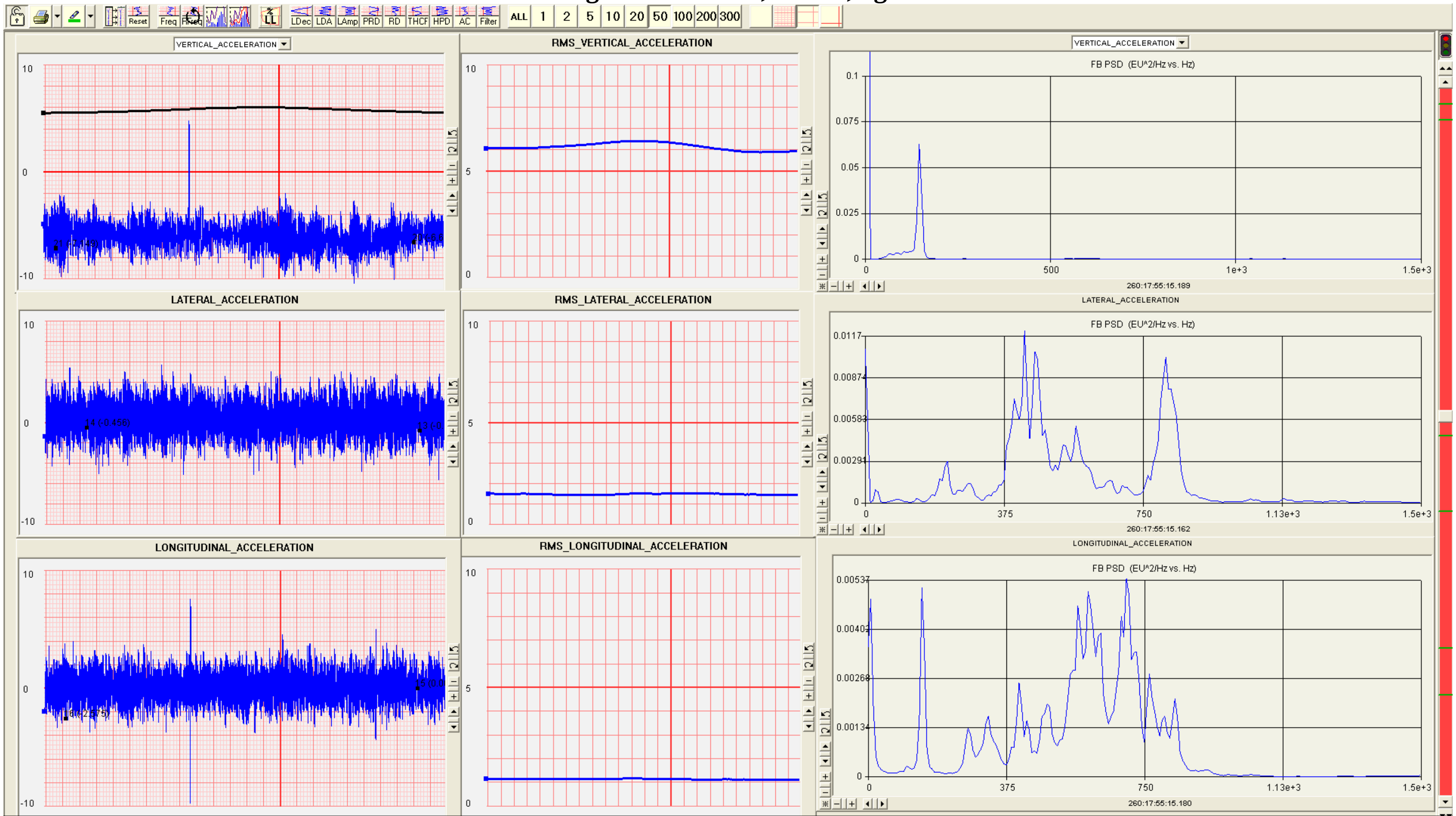
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A66: 25K, 1.17M, 3g



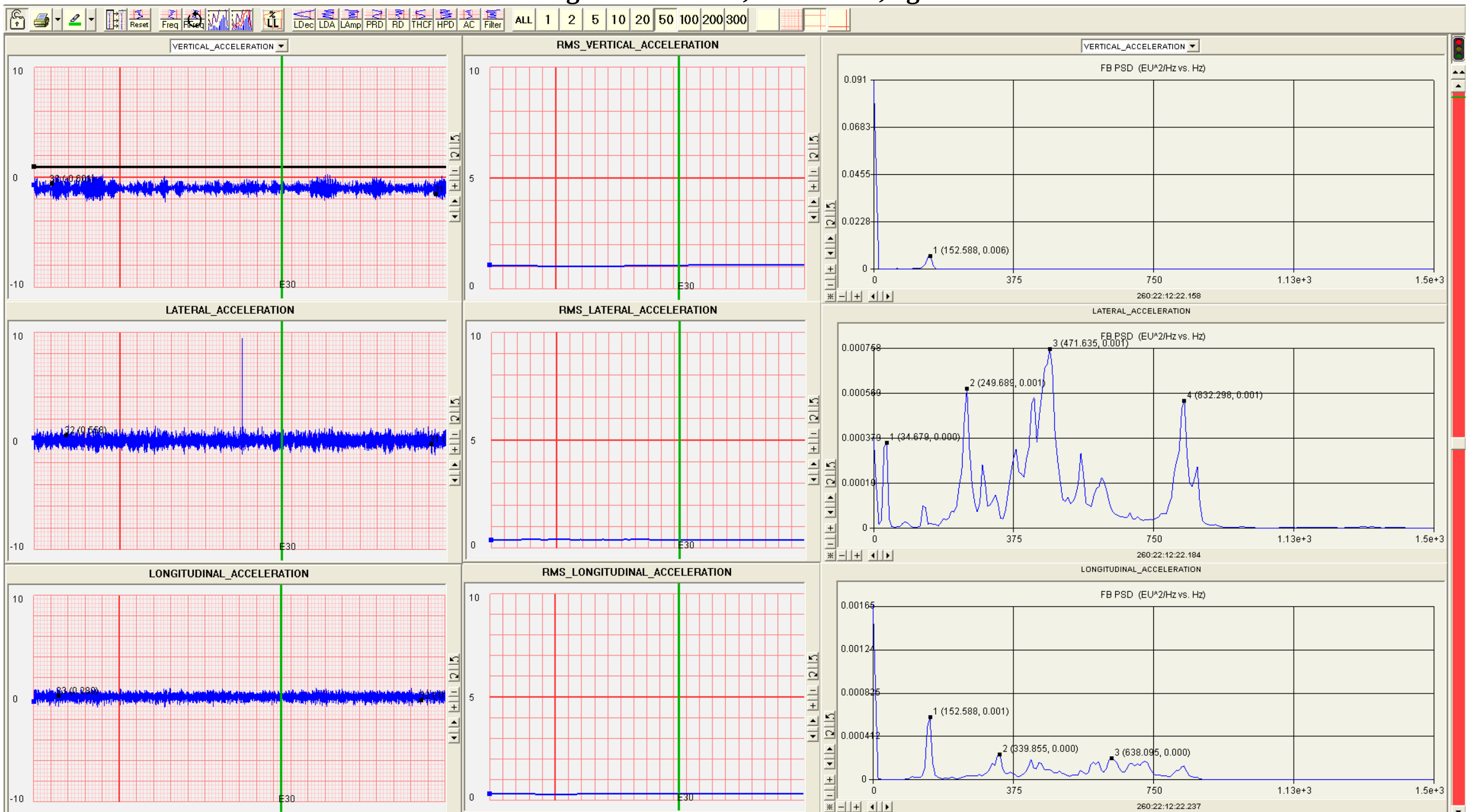
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A67: 25K, 1.17M, 6g



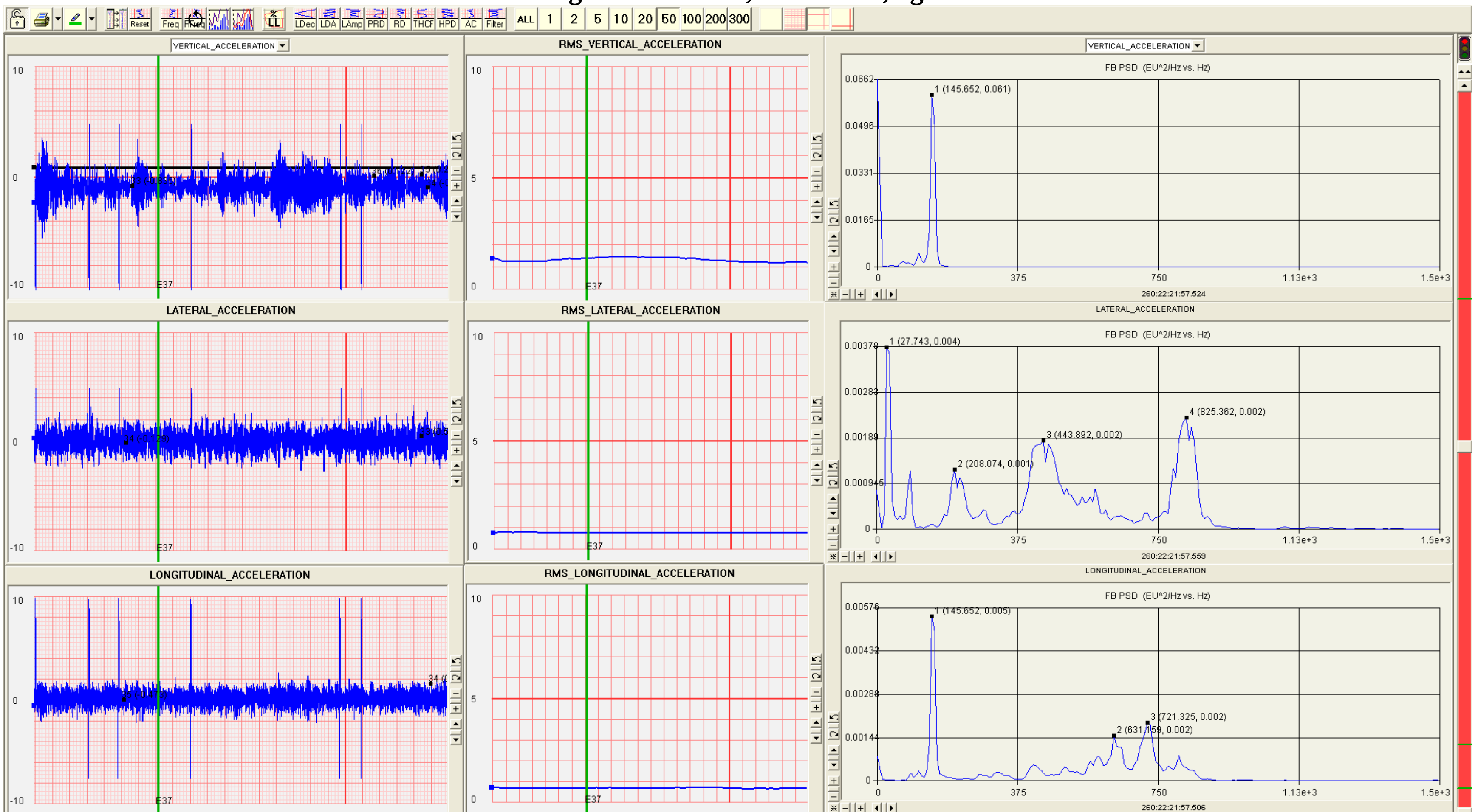
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A68: 35K, 250 KCAS, 1g



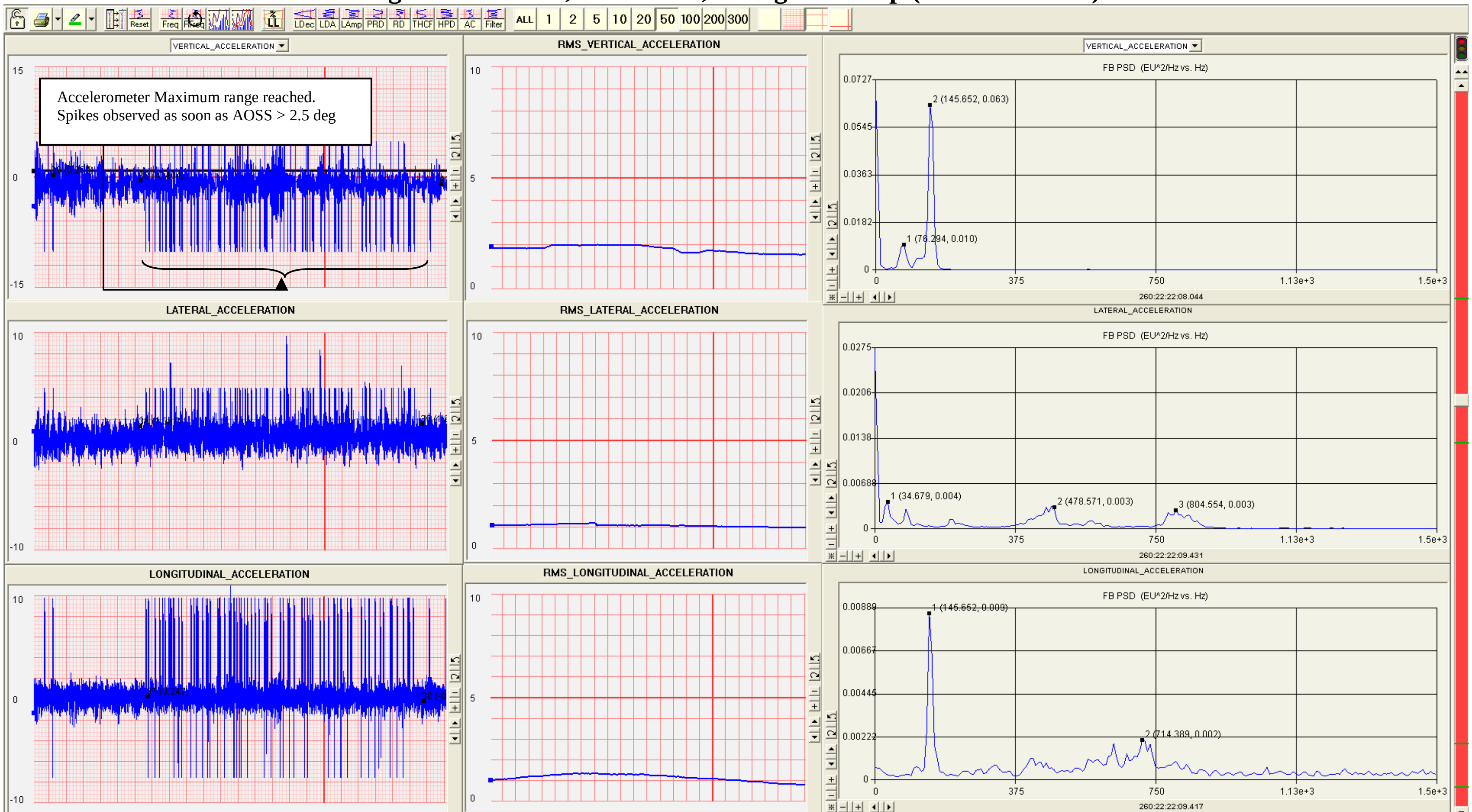
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A69: 35K, 324 KCAS, 1g



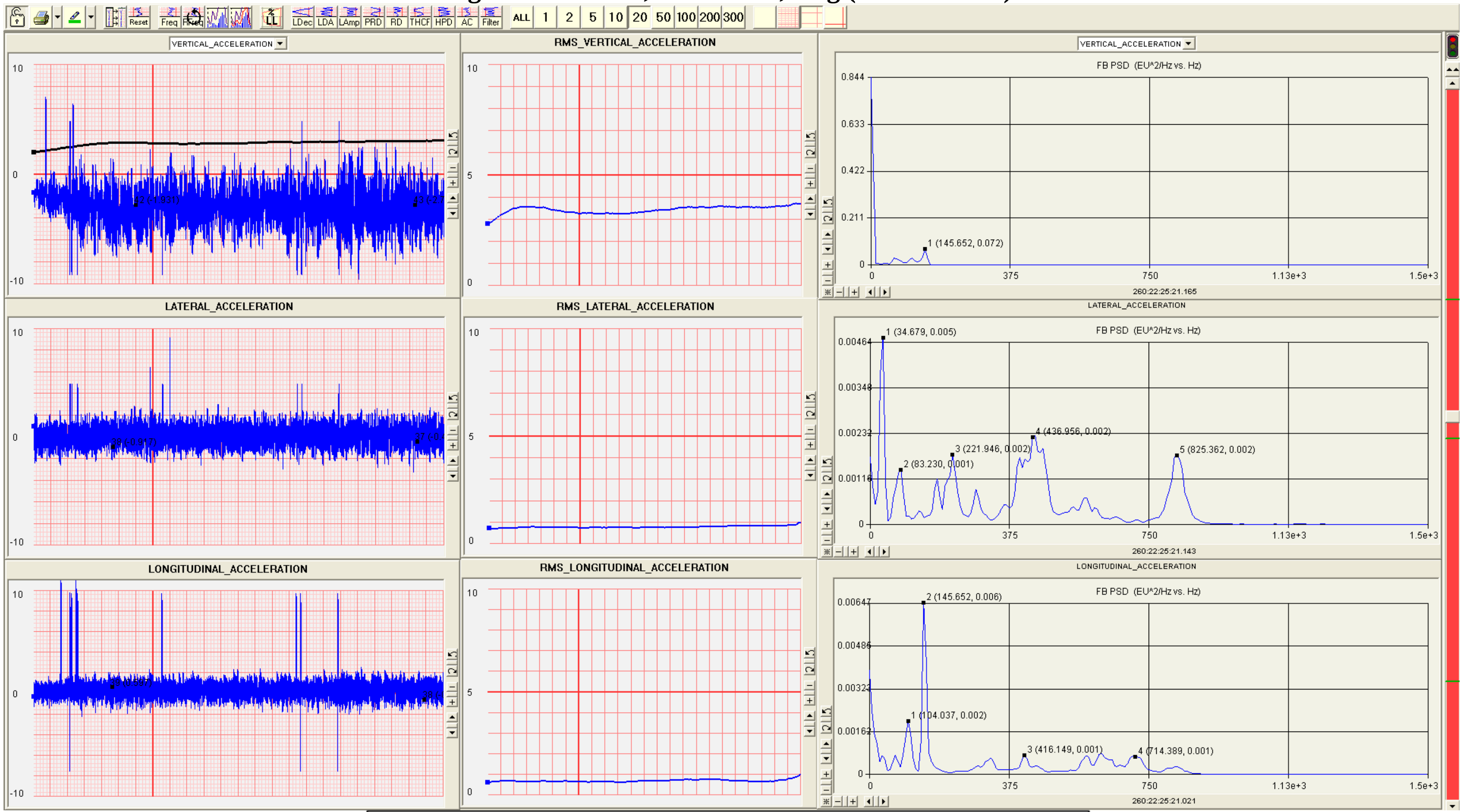
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A70: 35K, 324 KCAS, 6° Right sideslip (full left rudder)



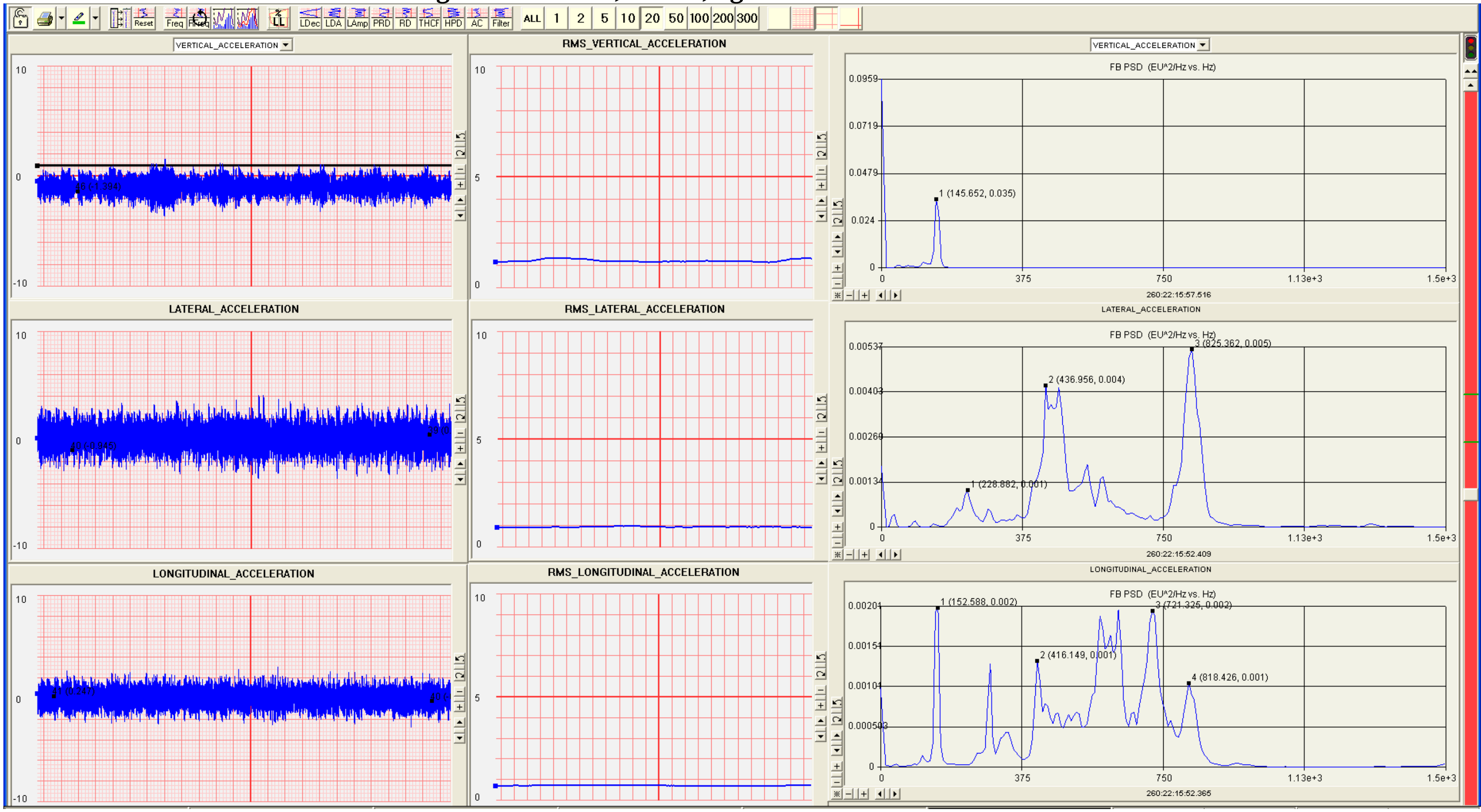
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A71: 35K, 324 KCAS, 3.1g (AOA limited)



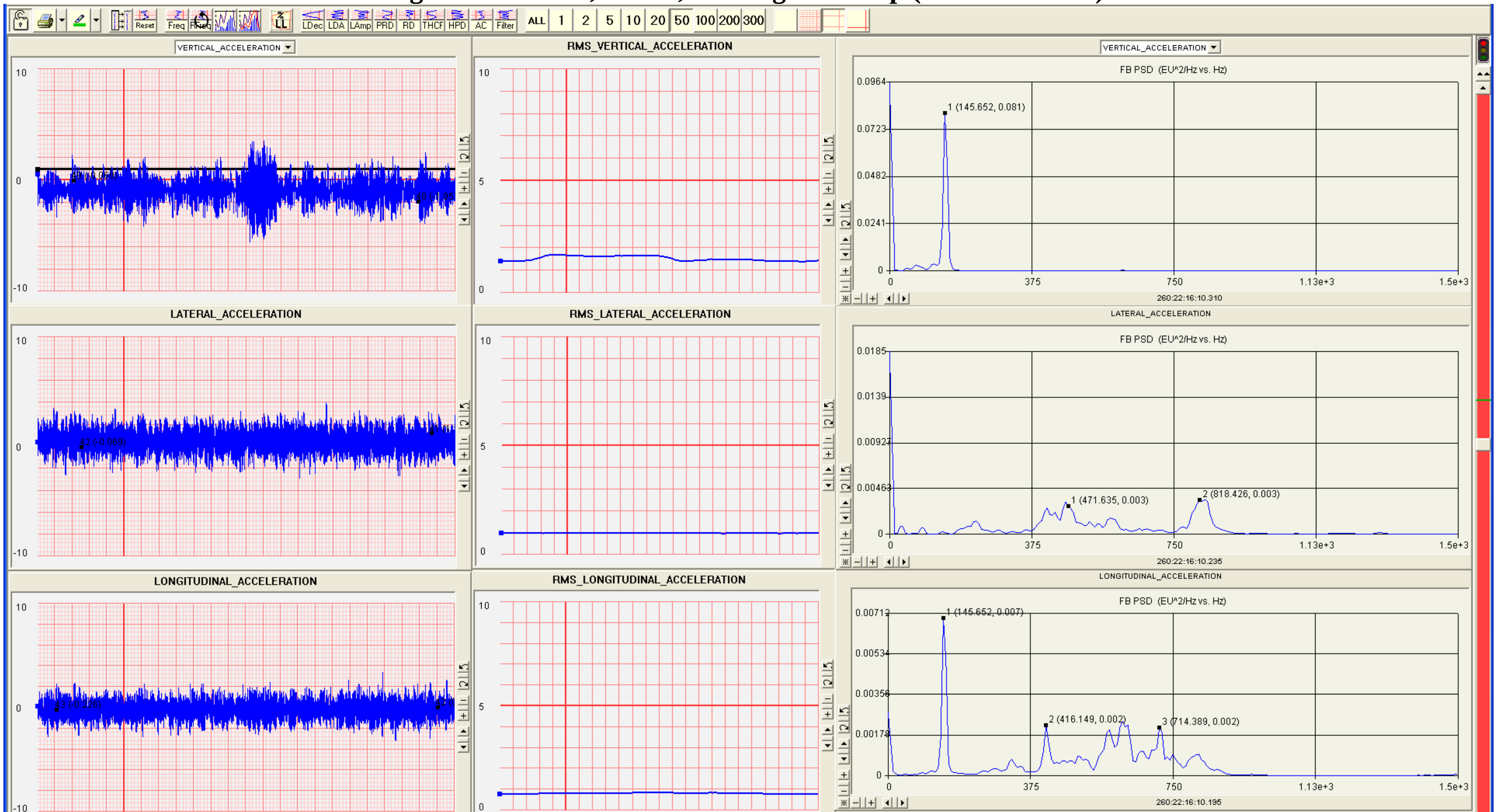
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A72: 35K, 1.17M, 1g



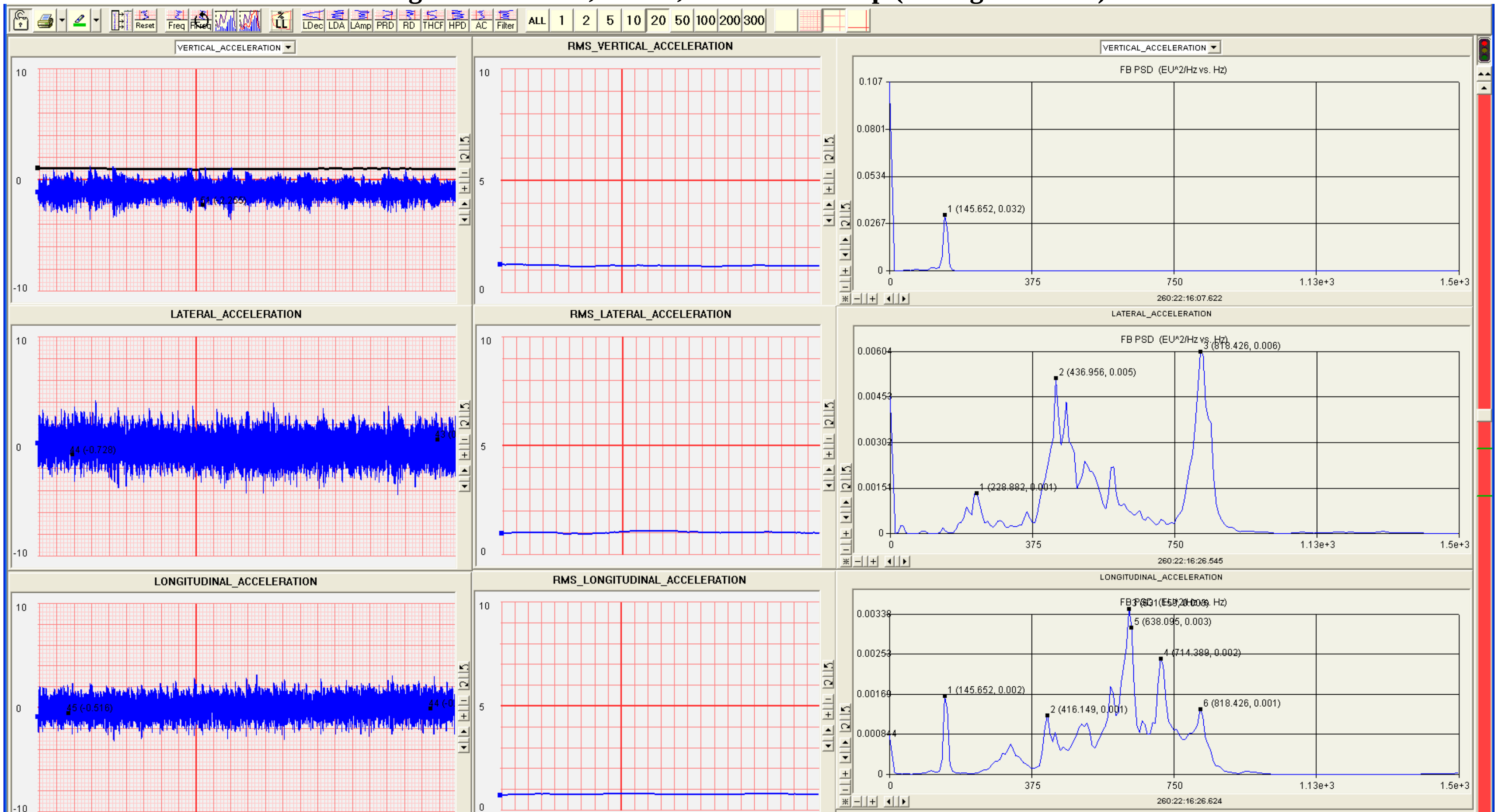
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A73: 35K, 1.17M, 3.2° Right sideslip (full left rudder)



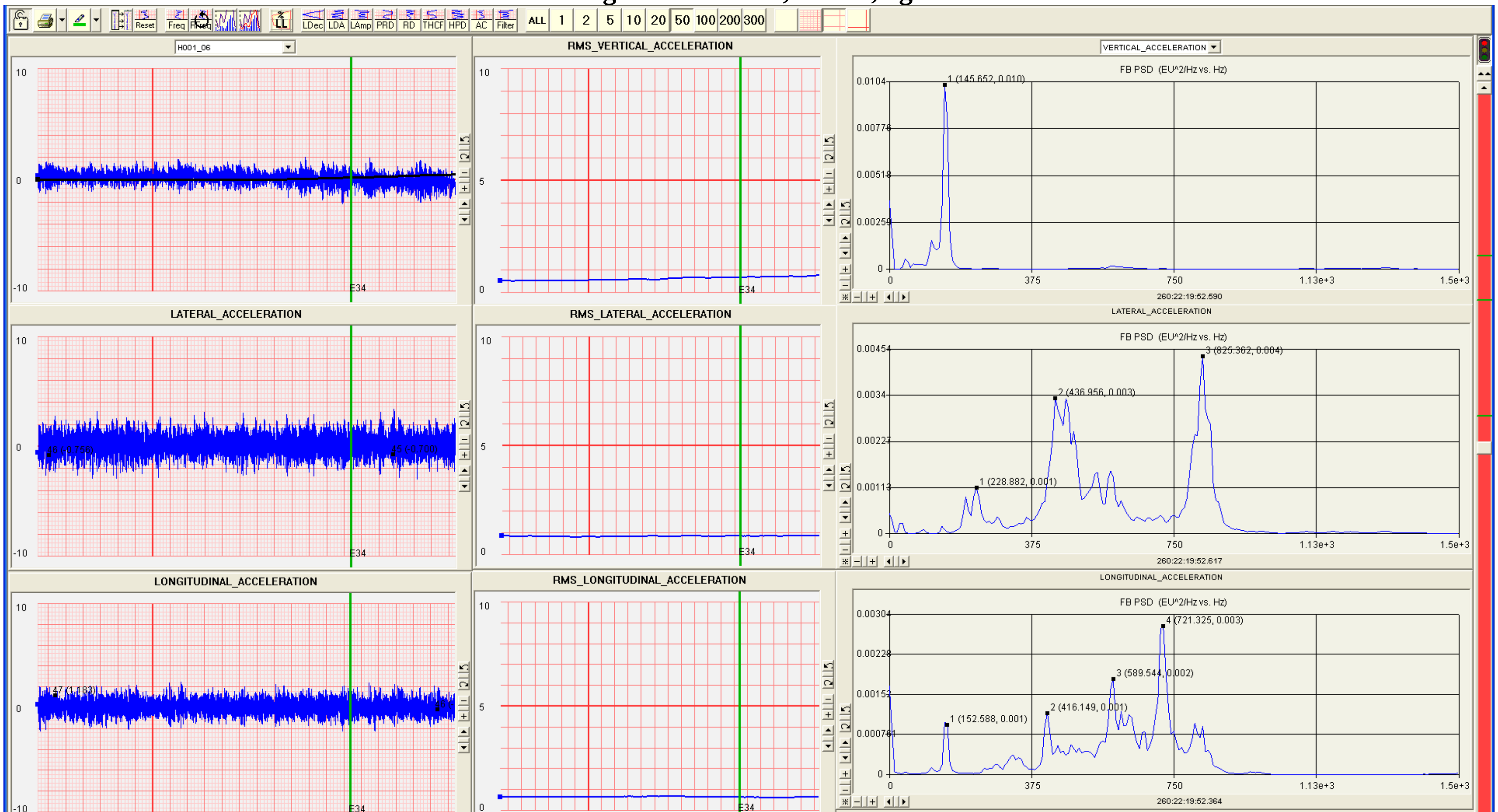
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A74: 35K, 1.17M, 4.4° Left sideslip (full right rudder)



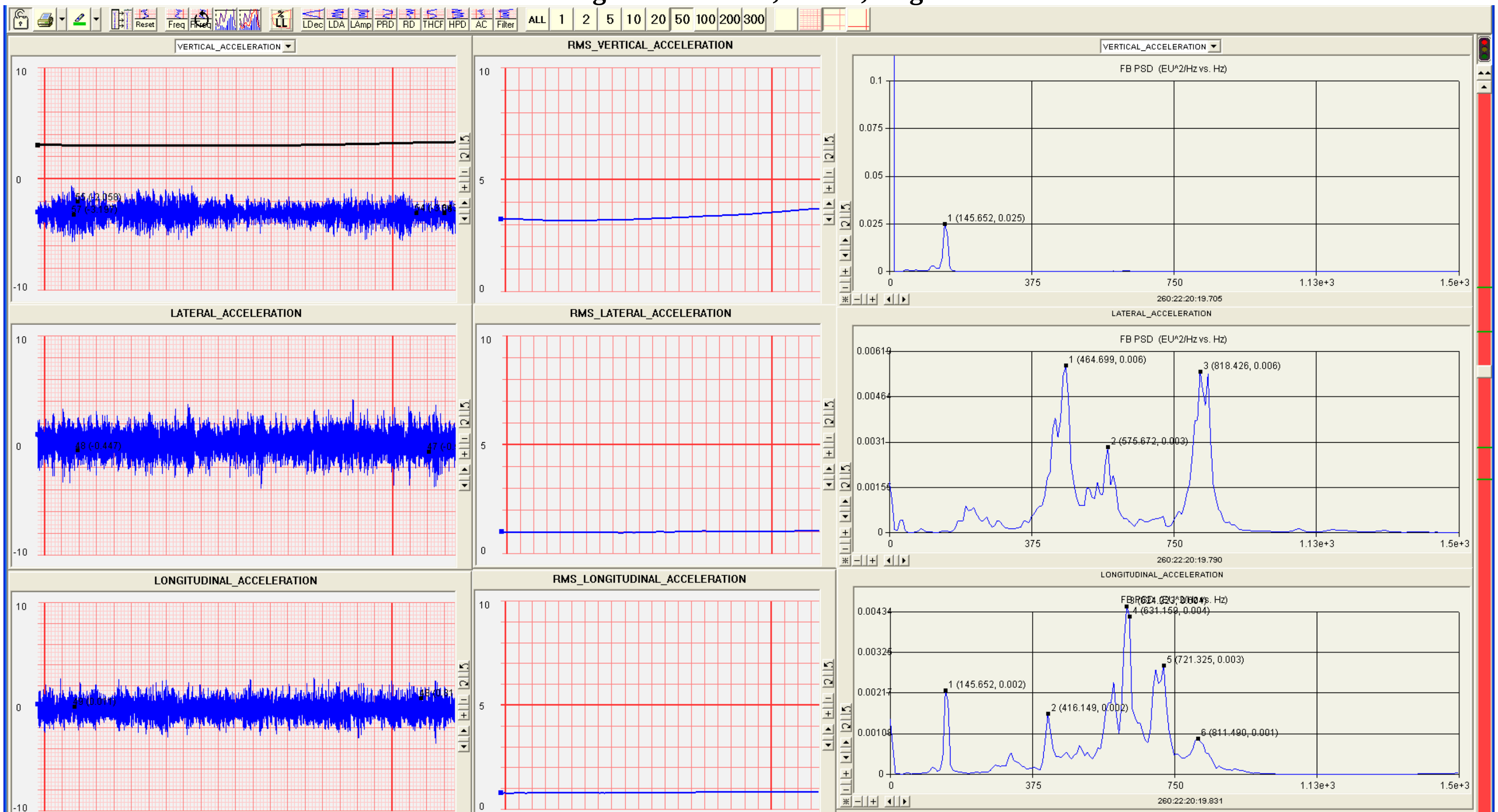
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A75: 35K, 1.17M, 0g



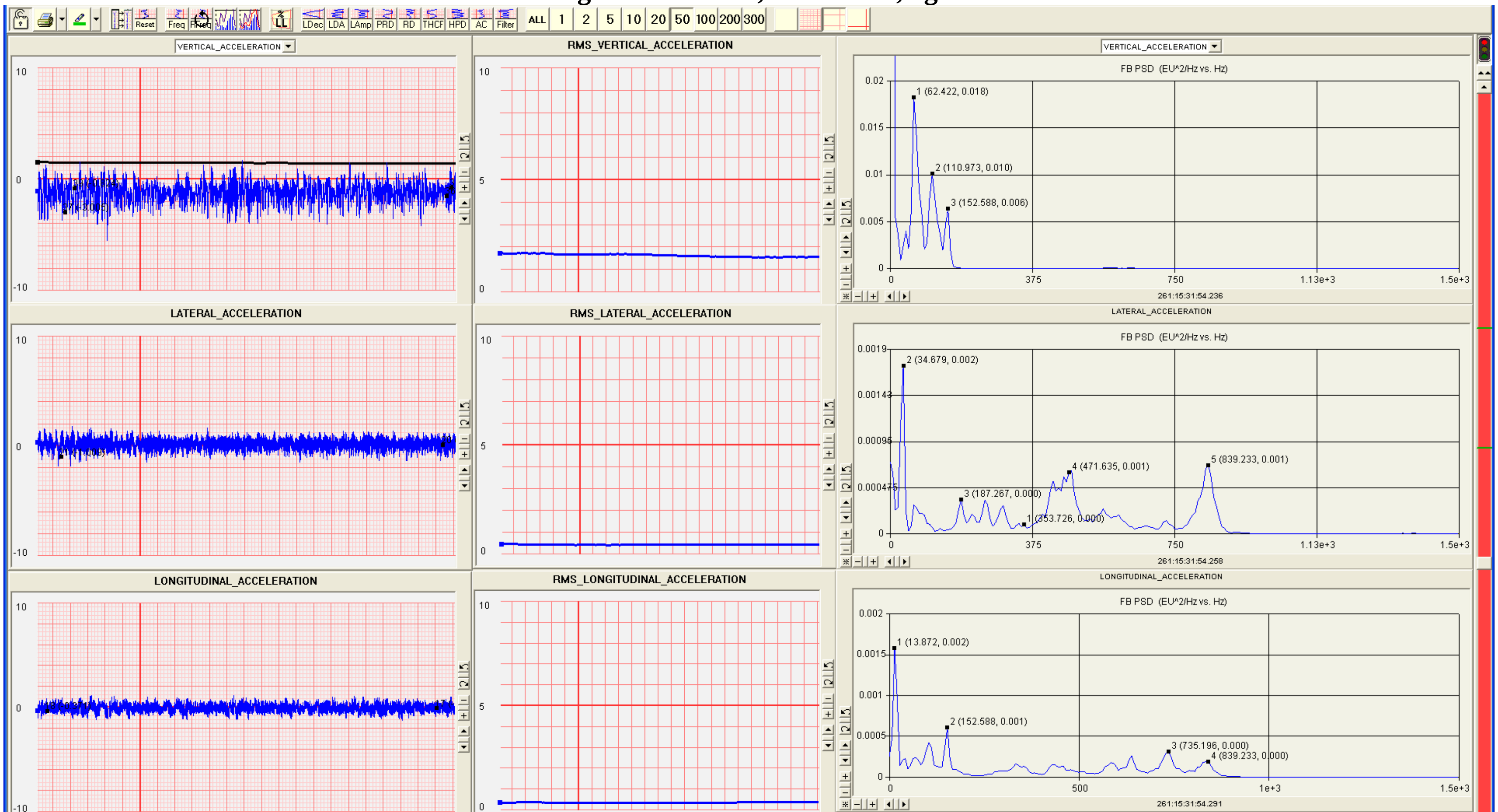
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A76: 35K, 1.17M, 3.2g



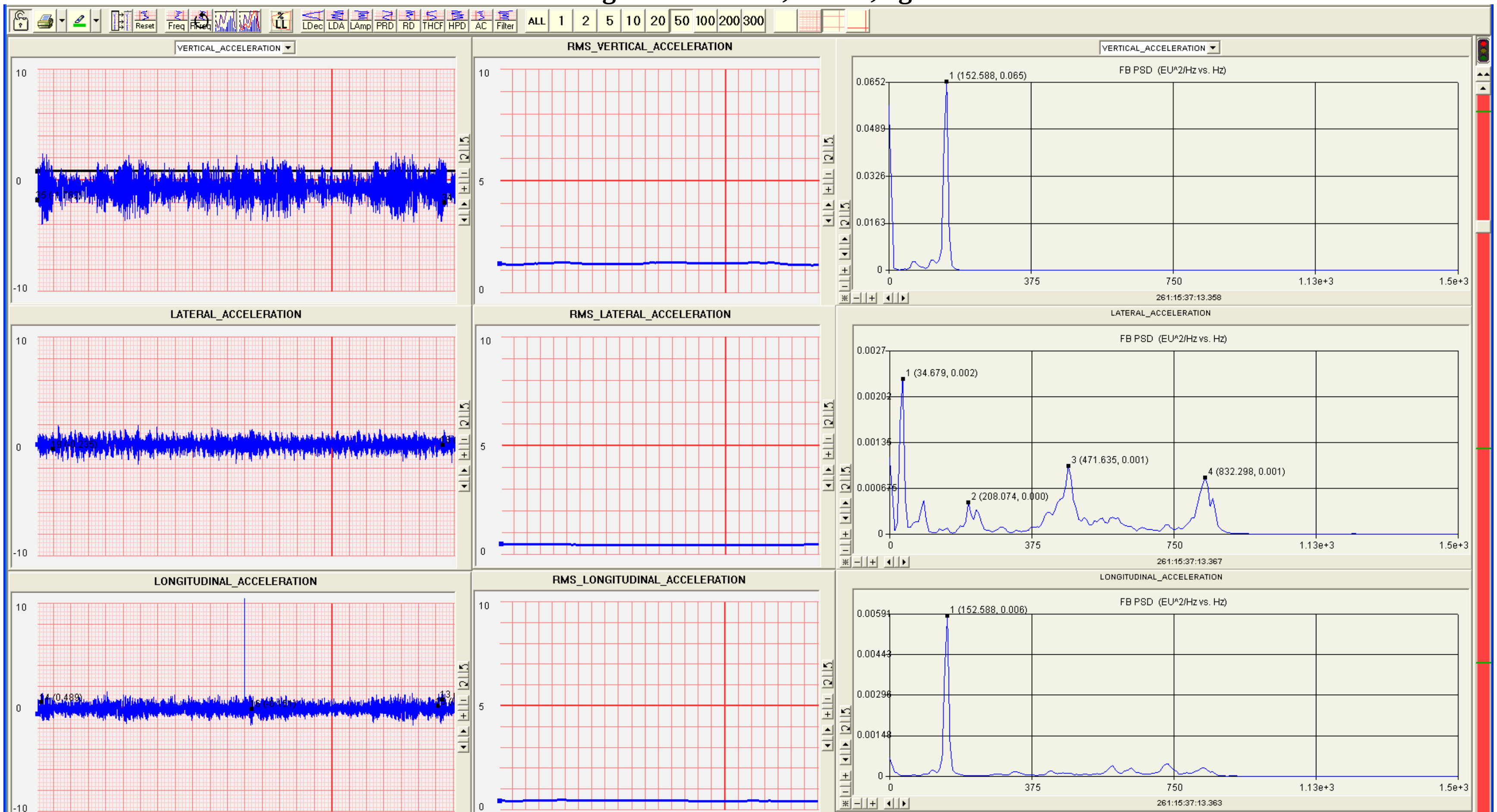
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A77: 45K, 250 KCAS, 1g



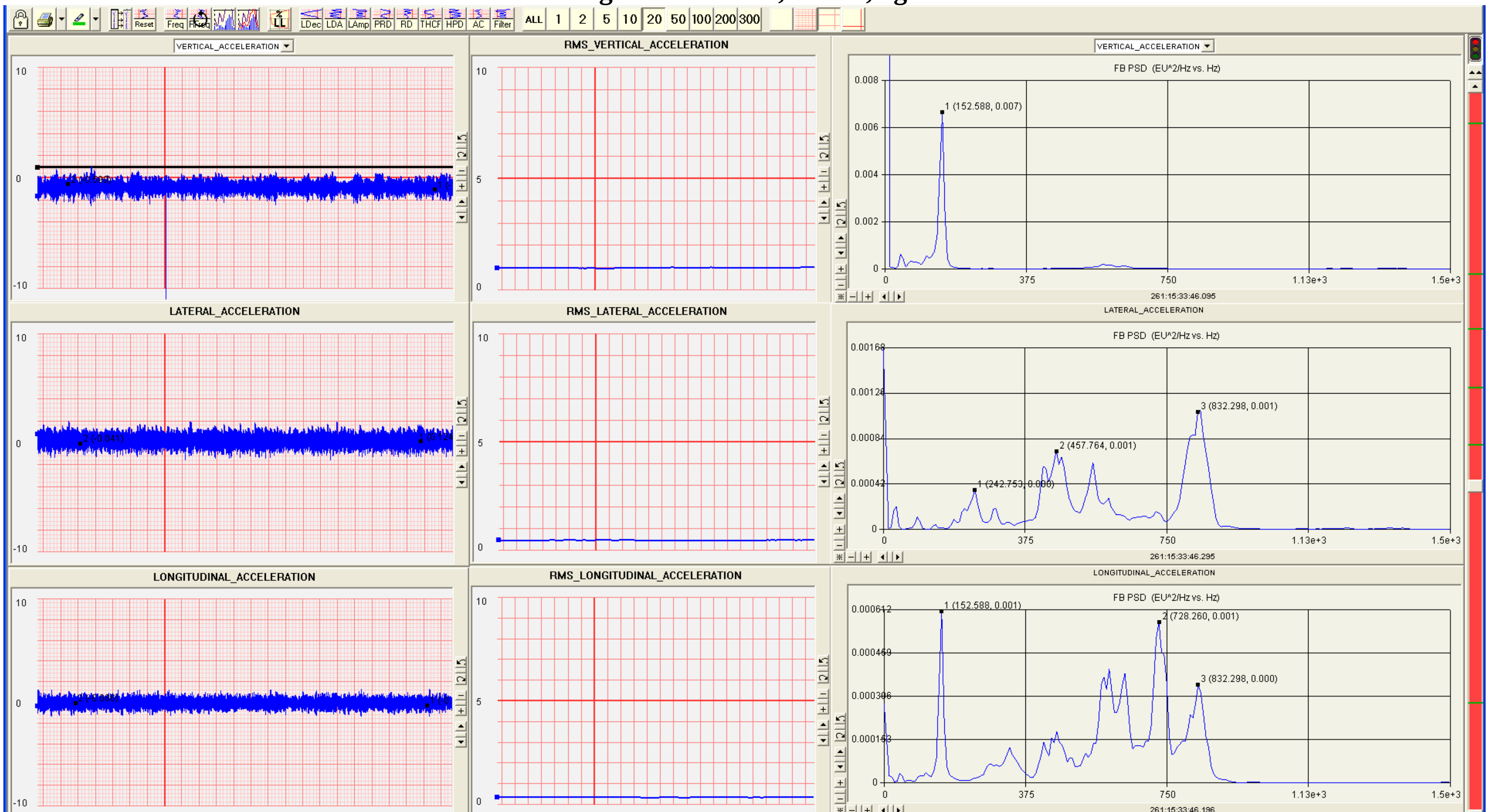
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A78: 45K, 0.94M, 1g



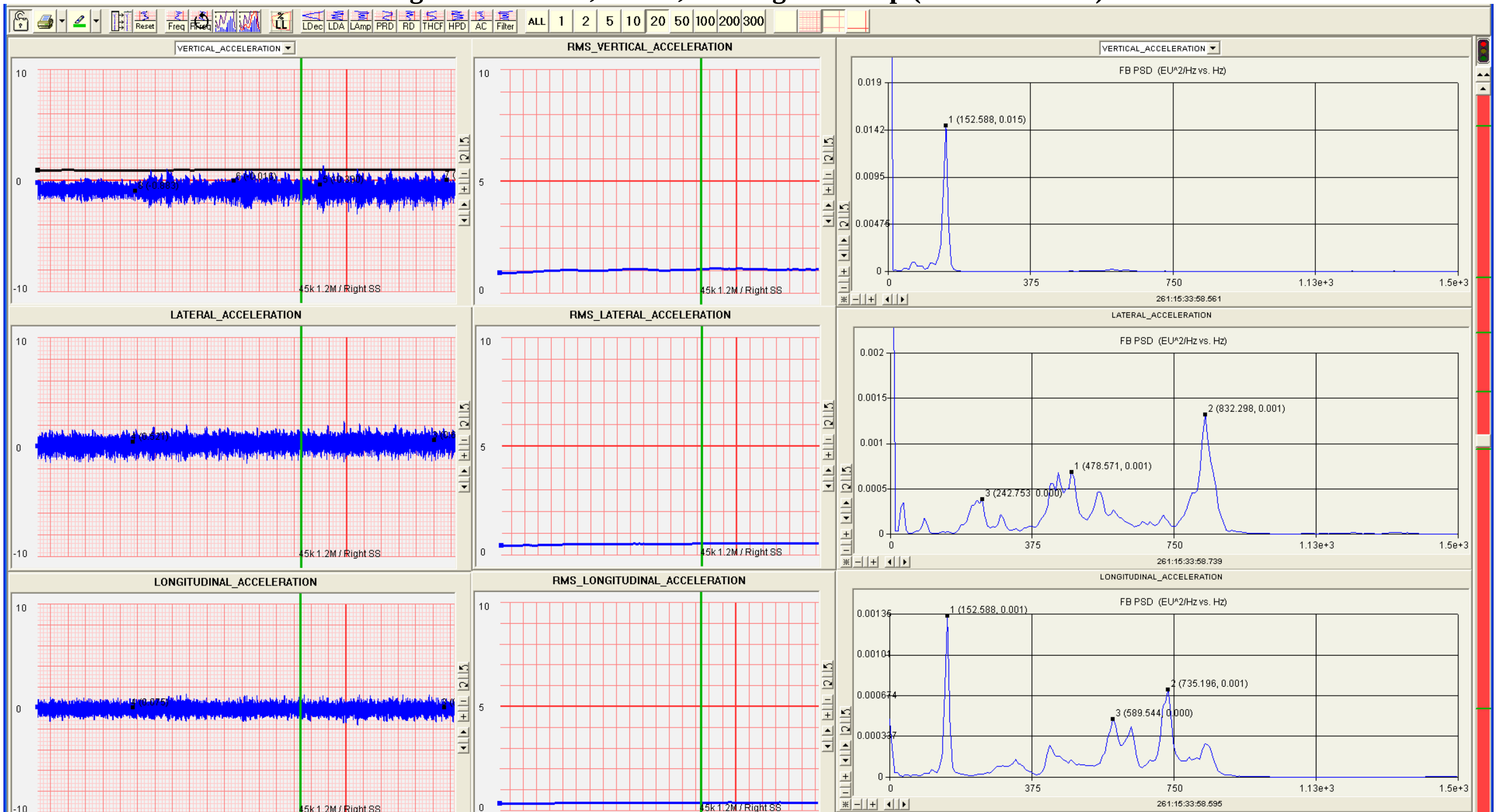
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A79: 45K, 1.17M, 1g



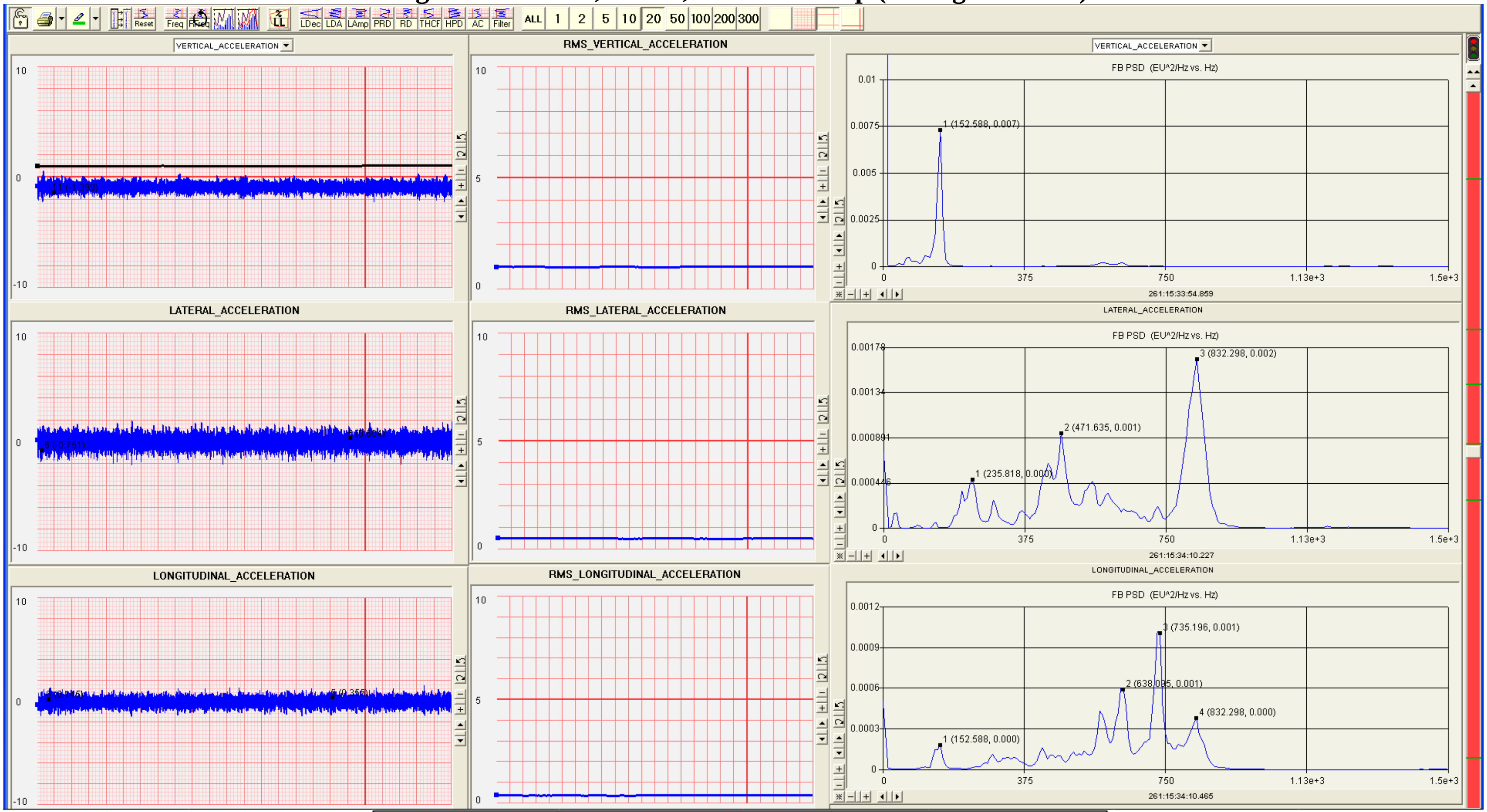
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A80: 45K, 1.17M, 2.5° Right sideslip (full left rudder)



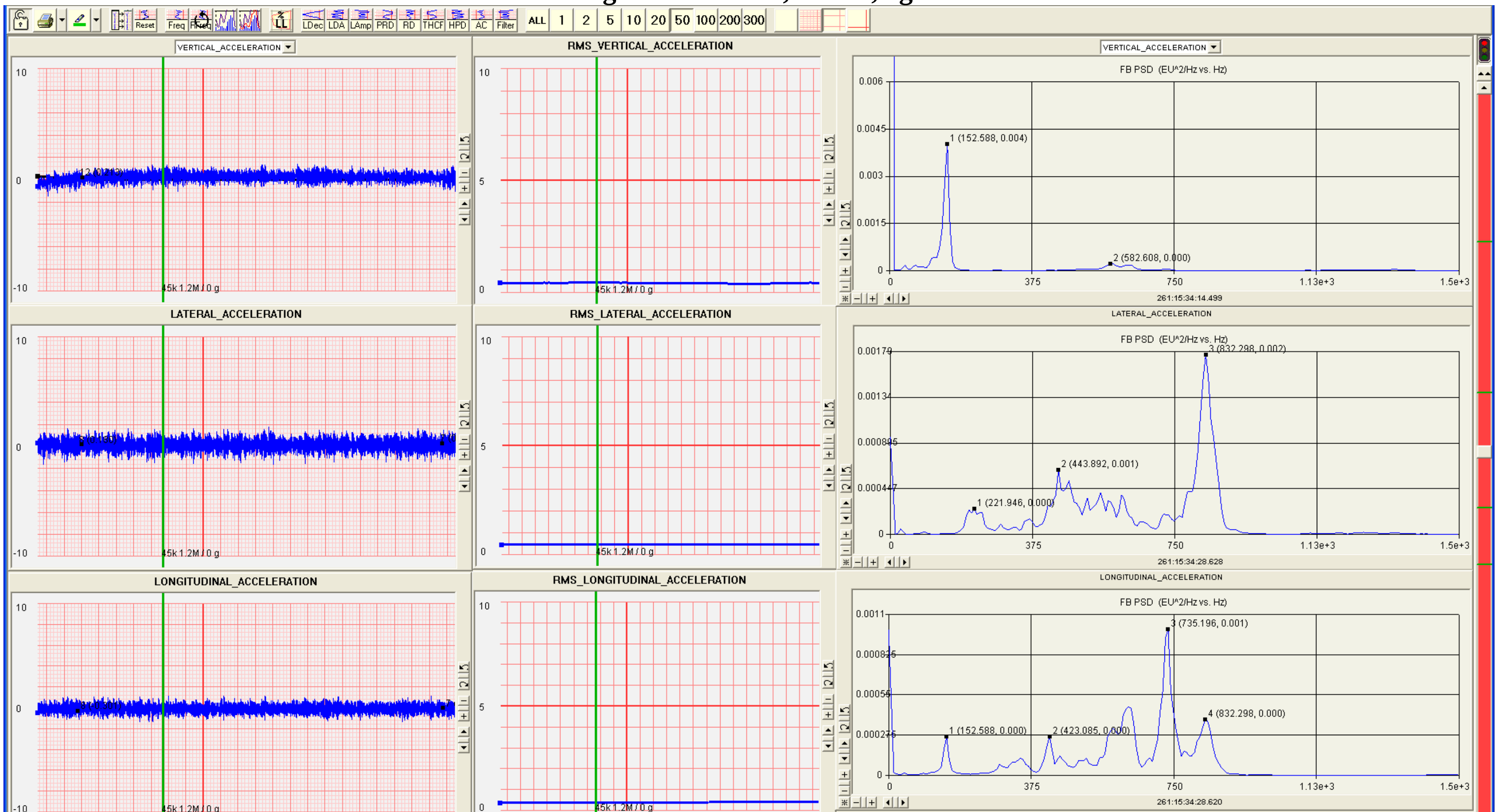
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A81: 45K, 1.17M, 4° Left sideslip (full right rudder)



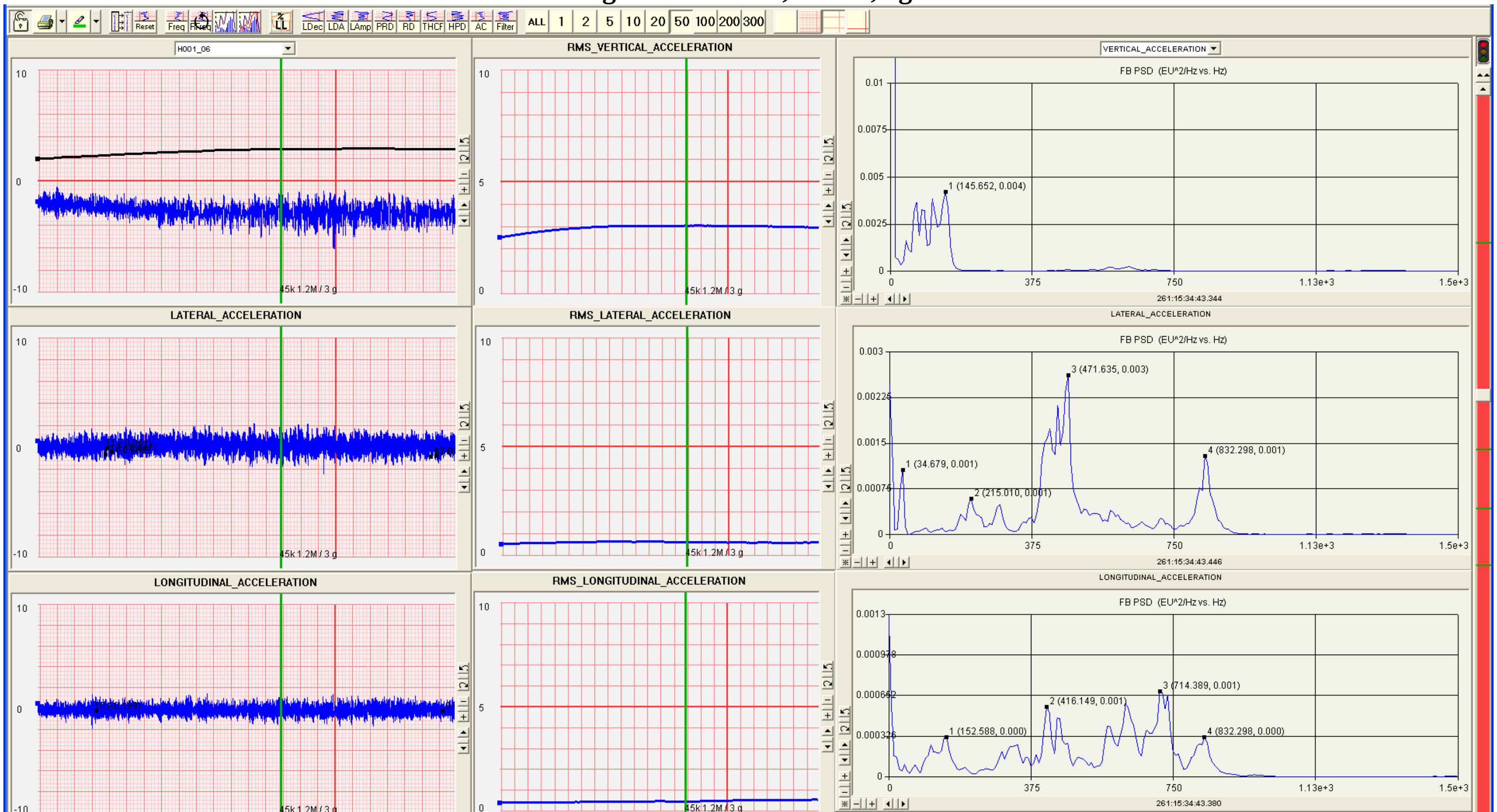
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A82: 45K, 1.17M, 0g



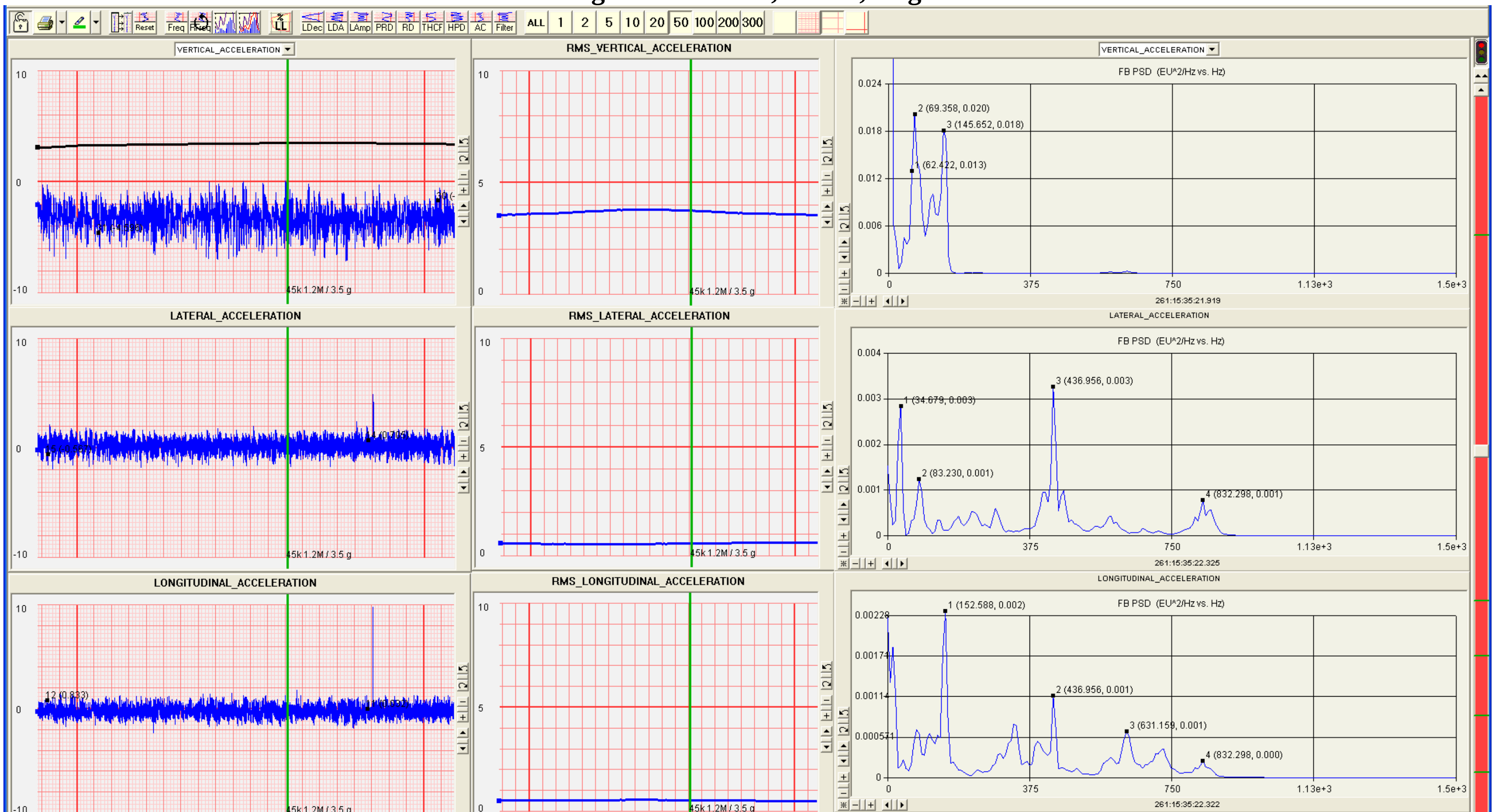
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A83: 45K, 1.17M, 3g



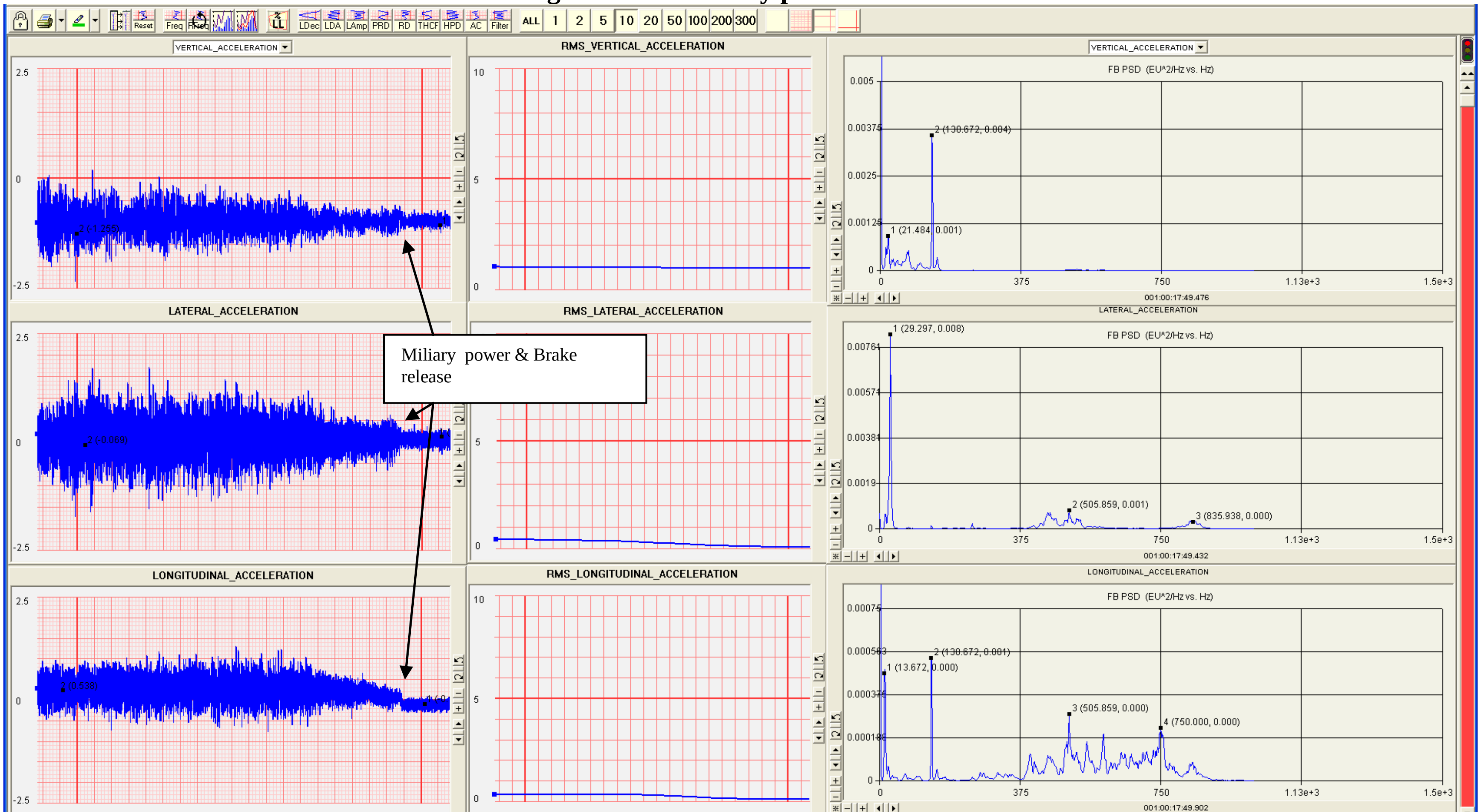
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A84: 45K, 1.17M, 3.5g



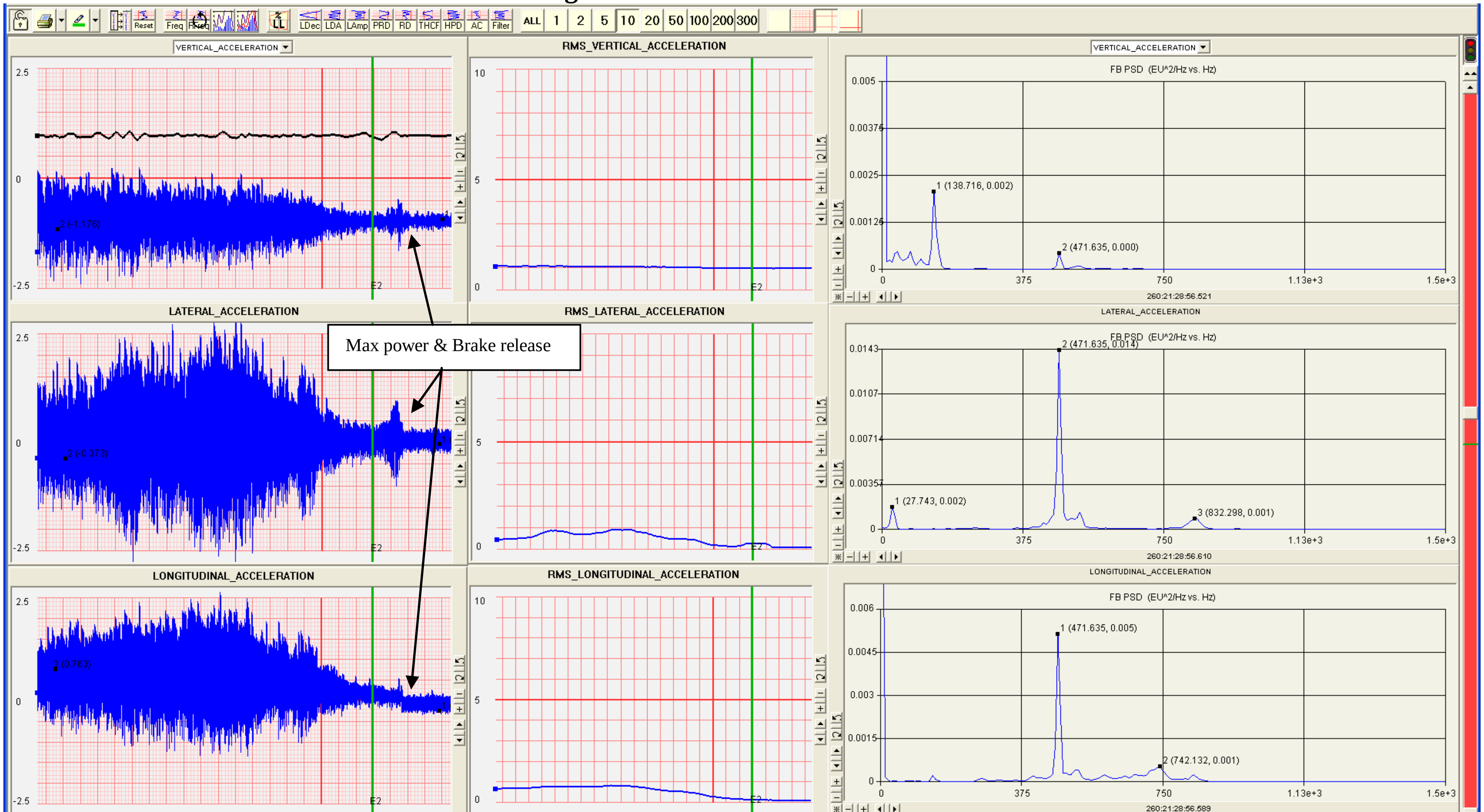
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	2.5 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A85: Military power Takeoff



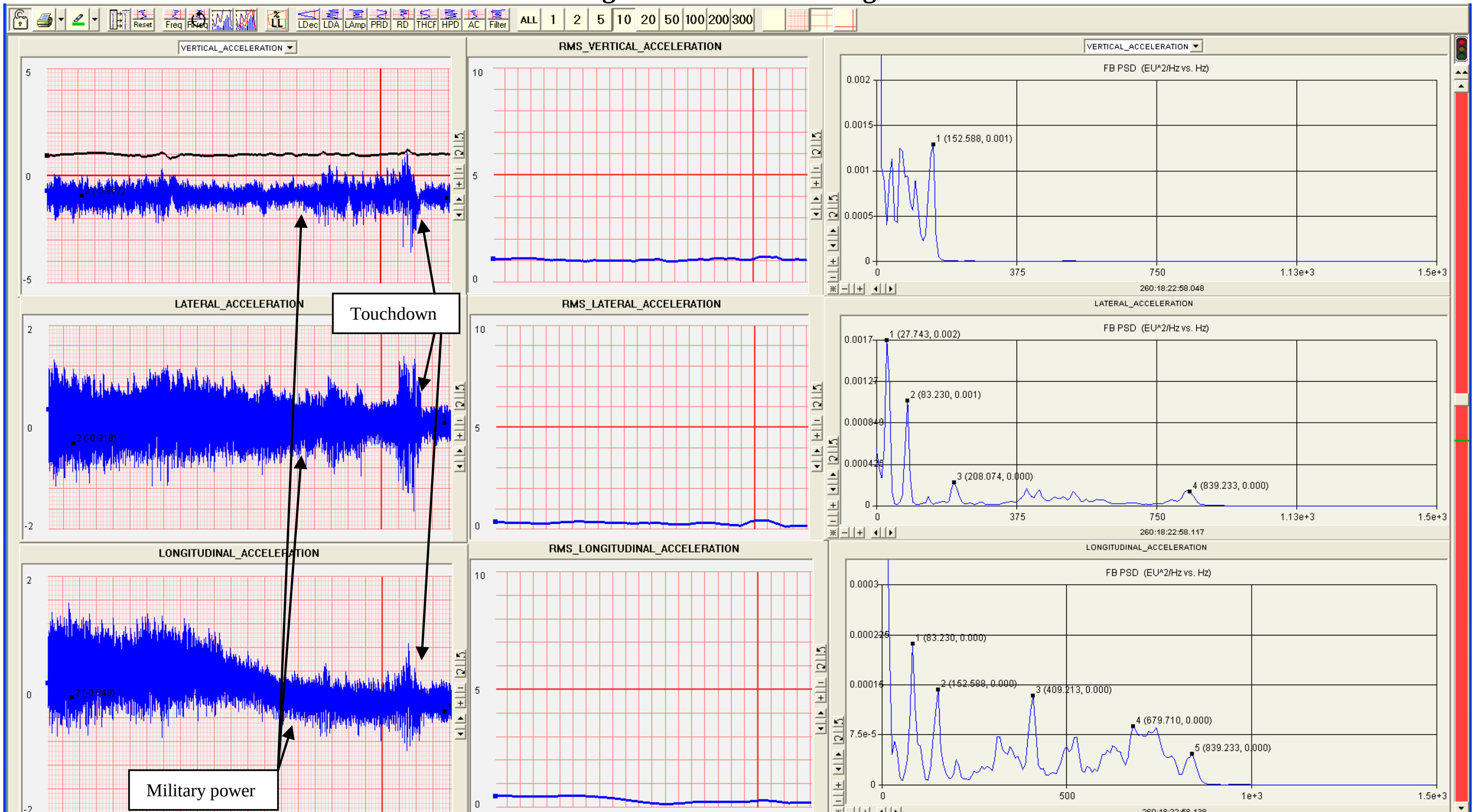
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	12 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A86: Afterburner Takeoff



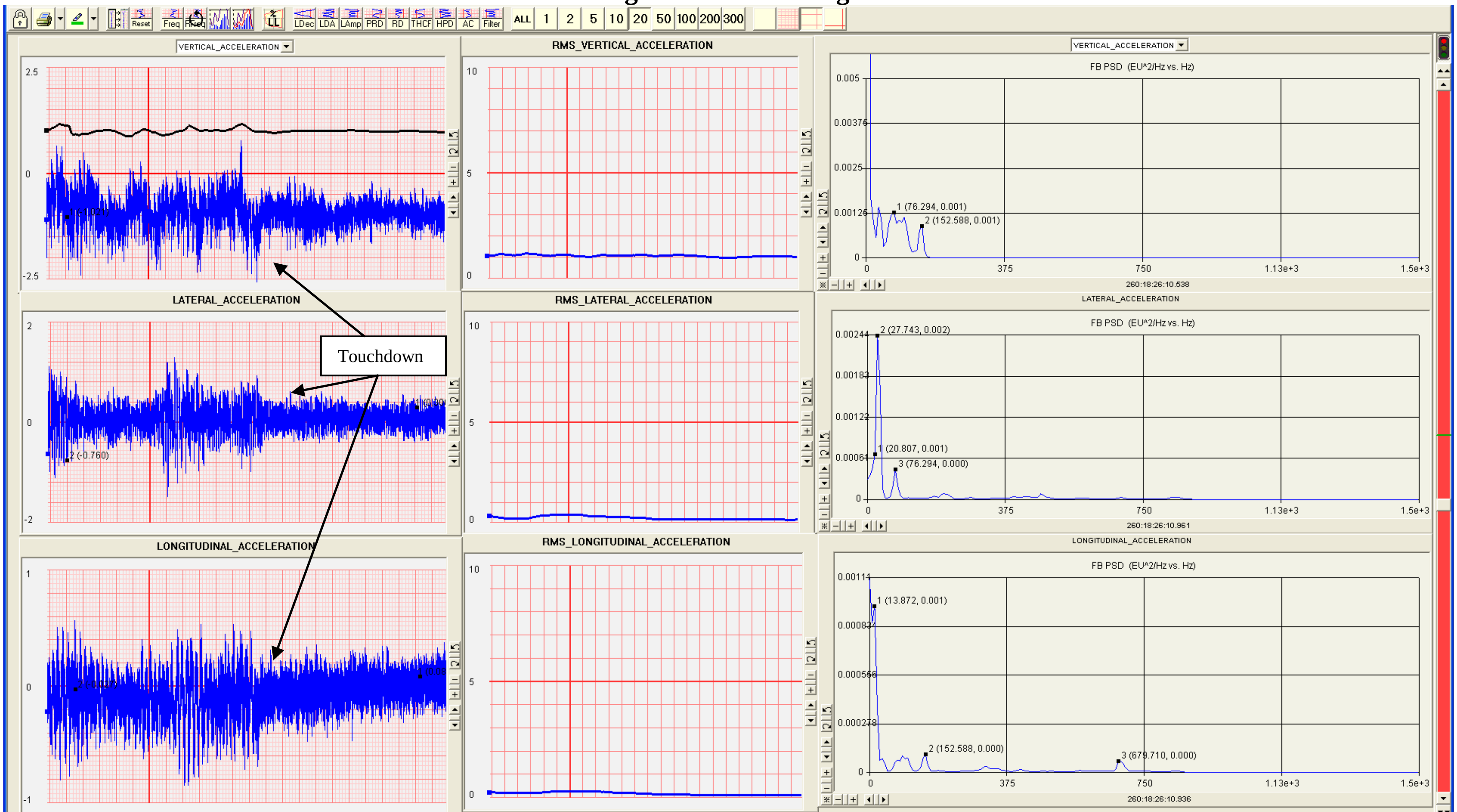
Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	12 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A87: Touch and go



Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	12 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Figure A88: Landing



Configuration: Cruise	Data Basis: Flight Test
Weight: 37,000 – 22,350 lb	Test Day Data
Test Dates: 15 – 18 Sept 2008	6 Sec Time Slide
All accelerations were in Gs	All PSDs were in G^2/HZ

Appendix B – Video Data

Video was recorded in the visual spectrum, 720 by 480 pixels interlaced at 30 frames per second (FPS) using the MPEG2 format. This encoding format resulted in resolution loss due to compression, but was unavoidable due to the design of the RASCAL DAS. The passes over the target areas of interest were deinterlaced and converted into 10 second duration sequences of still image frames. The frames were post processed using MATLAB by converting the images to 256 color grayscale and cropping the images at 256 by 256 pixels from the center of each frame. These frames were analyzed for pixel shift on a frame to frame basis by using interframe correlation of their two-way fast Fourier transforms. Figures E1 and E2 illustrate the mount configuration of the camera. Note that the camera was mounted to look down when the RASCAL pod was carried by the F-16.

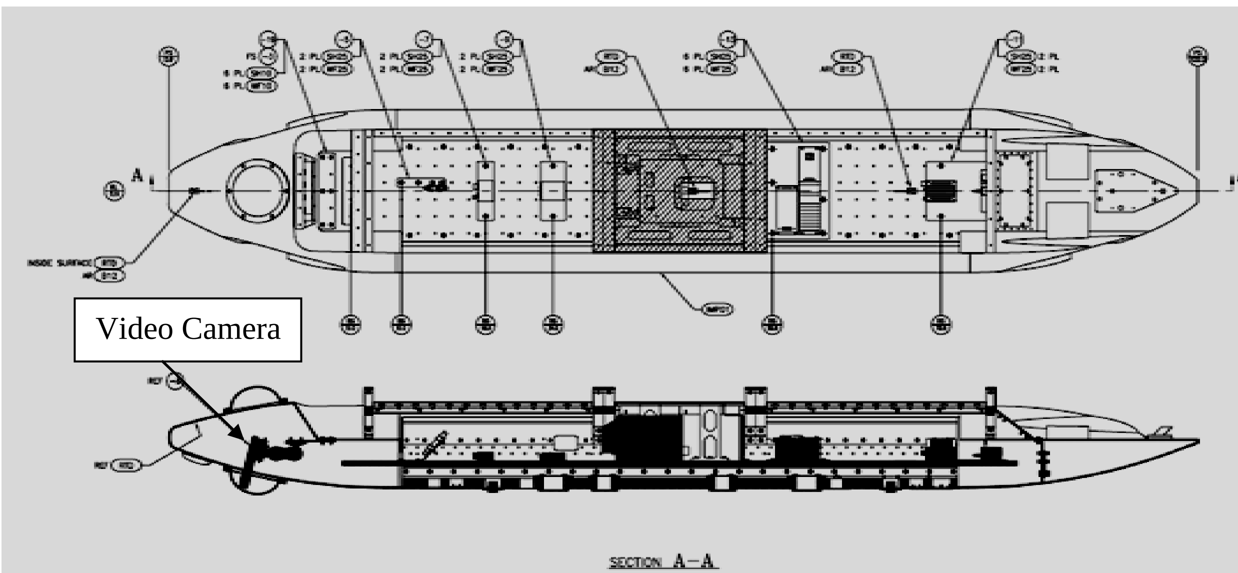


Figure B1: Video camera located in the forward compartment of the RASCAL pod.

Figure B2: Video Camera Installation

MATLAB processing was accomplished by means of three routines named "filecube.m", "image_cube_jitter.m", and "jitter_psd.m". The first routine is a function which builds an image cube in the MATLAB workspace for follow-on processing. The "filecube.m" function accepts an output matrix name and set of arguments defining the image files to be loaded. The images are iteratively loaded, converted to grayscale, and cropped to the desired size with offsets as required. The video files from these tests were cropped to the center of each frame.

```
function [matrix]=
filecube(groupname,start,extension,depth,width,height,offset_x,offset_y)
% function [matrix]=
% filecube(groupname,start,extension,depth,width,height,offset_x,offset_y)
%
% Creates a three dimensional matrix from a series of images.
% groupname is the first part of the name for the images which will comprise
the
% filecube.  start is the "number" of the first image in the group.
% All images to be loaded should be in working directory, and named in
% series with a pattern of "groupnamestart", "groupname(start+1)", ...
% extension is the file type and is case sensitive, eg: ('.tif')
% depth is the number of images to be loaded.
% width is the X axis cropped size.  Source images are expected to be larger
than this.
% height is the Y axis cropped size.  Source images are expected to be
% larger than this.
% offset_x positions the cropped result away from the origin in the X axis.
```

```
% offset_y positions the cropped result away from the origin in the Y axis.
% Written by Capt David Kern, TPS Class 08A
h = waitbar(0,'Please wait...');
for iteration = 1:depth
    color = imread(strcat(groupname,int2str(start+iteration-1),extension));
    bw = rgb2gray(color);
    cropped = bw(offset_y:offset_y+height-1, offset_x:offset_x+width-1);
    matrix(:,:,iteration) = double(cropped);
    waitbar(iteration/depth,h)
end
close(h);
```

The second MATLAB routine, named “image_cube_jitter.m”, is also a function. It accepts two output vector names and the name of an image cube generated from the previous routine as its arguments. The two vectors output by the function list the numbers of pixels each image is shifted from the previous, with integer precision. The first record of the lateral vector, “dx” is set to zero by definition, since it is the record corresponding to the first image. The first record of the longitudinal vector, “dy” is set to 7 pixels. This was discovered after the first run of the function to be the modal value of the longitudinal pixel shift caused by aircraft ground speed, and varied between 6 and 8 pixels depending on the run. Setting the first record of “dy” to the modal value of pixel shift avoided calculation error of the RMS pixel jitter. An integer was chosen rather than an alternative calculation method to simplify analysis. The iterative process at the heart of the “image_cube_jitter” function calls an outside function called “shift_est.m”, passing it adjacent images from the image cube.

```
function [dx,dy] = image_cube_jitter(img_cube)
% function [dx,dy] = image_cube_jitter(img_cube);
%
% takes as input a cube of image data (image_cube) and outputs a cube of
% registered image data, together with the registration shift vectors
%

cube_depth = size(img_cube,3);

dx = zeros(cube_depth,1);
dy = zeros(cube_depth,1);
dx(1) = 0; dy(1) = 7; % by definition since this is the first image

h = waitbar(0,'Please wait for Standard correlation registration...');

for ii = 2 : cube_depth
    % estimate each image's shift
    img1 = img_cube(:,:,ii-1);
    img2 = img_cube(:,:,ii);
    [dx(ii),dy(ii)] = shift_est(img1,img2);
    waitbar(ii/cube_depth,h);
end
close(h);
```

The function “shift_est.m” is documented below. This function identifies the global image shift between two images by correlation in the frequency domain. The two way Fast Fourier Transforms (FFT) for both images are multiplied as arrays after taking the complex conjugate of

the first image. The resultant array is converted back to the spatial domain via inverse FFT, and the complex component is removed to consider only the real component. The lateral and longitudinal pixel shifts are determined by identifying the address of the maximum value within the array.

```
function [dx,dy] = shift_est(img1,img2)
% function [dx,dy] = shift_est(img1,img2)
%
% Steve Cain's fast image correlation algorithm, AFIT
%
% images img1 and img2 are compared via fast correlation of the entire
% image and the peak of the cross-correlation function is used to estimate
% the global image shift between images.
% Only estimates integer shifts

sz=size(img1);
vec=1:sz(1);
mi=floor(sz(1)/2)+1;
vec=vec-mi;
vecx=ones(sz(1),1)*vec;
vecy=vec'*ones(1,sz(2));
corr=real(ifft2(conj(fft2(img1)).*fft2(img2)));
corr=fftshift(corr);
%dx = sum(sum(vecx.*corr.*binmap))/sum(sum(corr.*binmap));
%dy = sum(sum(vecy.*corr.*binmap))/sum(sum(corr.*binmap));
[dy,dx]=find(corr==max(max(corr)));
dy=dy-mi;
dx=dx-mi;
```

The vectors "dx" and "dy" are used by the MATLAB script "image_jitter.m" to compute the RMS jitter and respective PSDs for both lateral and longitudinal axes. PSDs are calculated using the Welch method. Both vectors are segmented into two equal length sections with 50 percent overlap, and are Hamming windowed at the segment length. The PSD magnitudes were scaled by a conversion factor from pixels to milliradians based upon the above ground level altitude for each test point. This conversion factor was adjusted for each pass based upon altitude above ground level.

```
% Image Jitter PSD Calculator

% Used after pixel shifts have been calculated in both dimensions, now to
plot the PSD
% Written by Capt David Kern
% USAF Test Pilot School, Class 08A

NFFT = 2^nextpow2(300); % Next power of 2 from length of y
f = 30/2*linspace(0,1,NFFT/2);
length = size(dx,1);
[Pdx,F] = pwelch(dx,length,[],NFFT,30);
[Pdy,F] = pwelch(dy,length,[],NFFT,30);
Pdx = Pdx*0.662
Pdx = Pdy*0.662
figure, semilogy(f,Pdx(1:256))
title('Power Spectral Density of Lateral Image Jitter at 0.6M, 5000 feet PA')
```

```
AXIS([0 15 1E-6 1E3])
xlabel('Frequency (Hz)')
ylabel('milliradians^2 / Hz')
figure, semilogy(f,Pdy(1:256))
title('Power Spectral Density of Longitudinal Image Jitter at 0.6M, 5000 feet
PA')
AXIS([0 15 1E-6 1E3])
xlabel('Frequency (Hz)')
ylabel('milliradians^2 / Hz')
figure, plot(dx), title('Lateral Pixel Shift at 0.6M, 5000 feet PA')
xlabel('Frame Number')
ylabel('Pixels')
ylim([-2 2])
set(gca,'ytick',[-2 -1 0 1 2])
figure, plot(dy), title('Longitudinal Pixel Shift at 0.6M, 5000 feet PA')
xlabel('Frame Number')
ylabel('Pixels')
ylim([4 9])
set(gca,'ytick',[4 5 6 7 8 9])
% Now calculate the RMS levels for dx and dy
bias=mean(dy);
RMSx=0;
RMSy=0;
for i=1:length
    RMSx=RMSx+dx(i)^2;
    RMSy=RMSy+(dy(i)-bias)^2;
end
RMSx=sqrt(RMSx/length)
RMSy=sqrt(RMSy/length)
```

The test team calculated the angular relationship between image pixels which converted measurements of jitter from units of pixels to milliradians (mr). Still frames from the video segments were fitted together into a composite image, and the pixel distance was measured between distinct ground references. This was related to the ground distance between the two reference points, establishing a foot/pixel relationship. Using the above ground level altitude during each video pass provided a foot/mr relationship, which was used to derive the pixel/mr value for each pass.

Figure B3 shows the analysis for the first pass over Mohave airport at 0.6 Mach and 2,205 feet AGL. This data showed 3.33 feet/pixel and 1.51 pixels/mr, resulting in 0.662 mr/pixel.

Figure B4 shows the analysis for the first pass over California City at 0.6 Mach and 2,581 feet AGL. This data showed 3.9 feet/pixel and 1.51 pixels/mr, resulting in 0.662 mr/pixel.

Figure B5 shows the analysis for the second pass over Mohave Airport at 0.75 Mach and 2,245 feet AGL. This data showed 3.42 feet/pixel and 1.52 pixels/mr, resulting in 0.656 mr/pixel.

Figure B6 shows the analysis for the second pass over California City at 0.6 Mach and 2,581 feet AGL. This data showed 4.0 feet/pixel and 1.50 pixels/mr, resulting in 0.667 mr/pixel.

Figure B3: Mohave Airport Image Composite at 0.6 Mach

Figure B4: California City Image Composite at 0.6 Mach

Figure B5: Mojave Airport Image Composite at 0.75 Mach

Figure B6: California City Composite at 0.75 Mach

The following plots depict the results of the video jitter analysis.

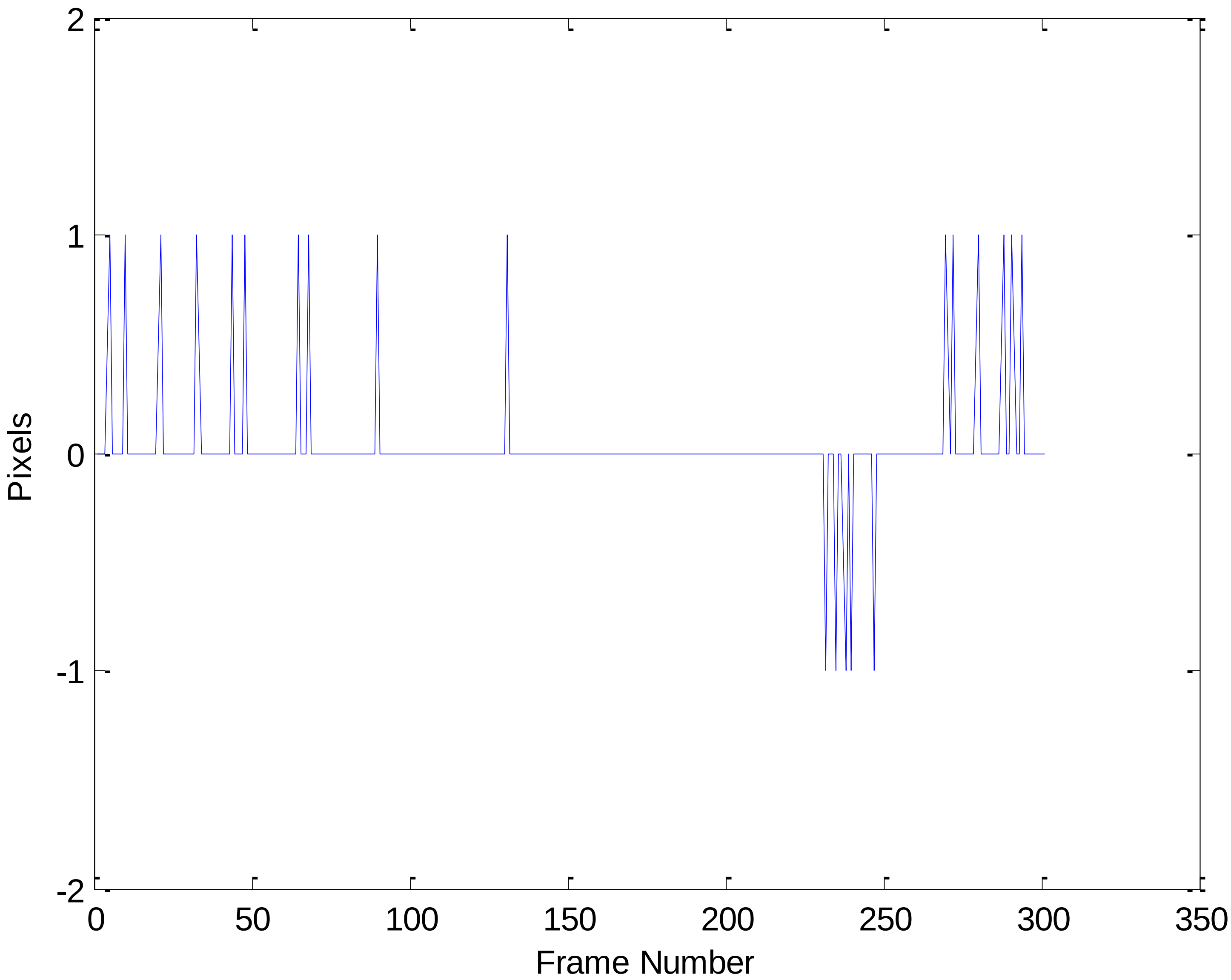


Figure B7: Lateral Pixel Shift at 5,000 ft PA / 0.6M (Mojave Airport)

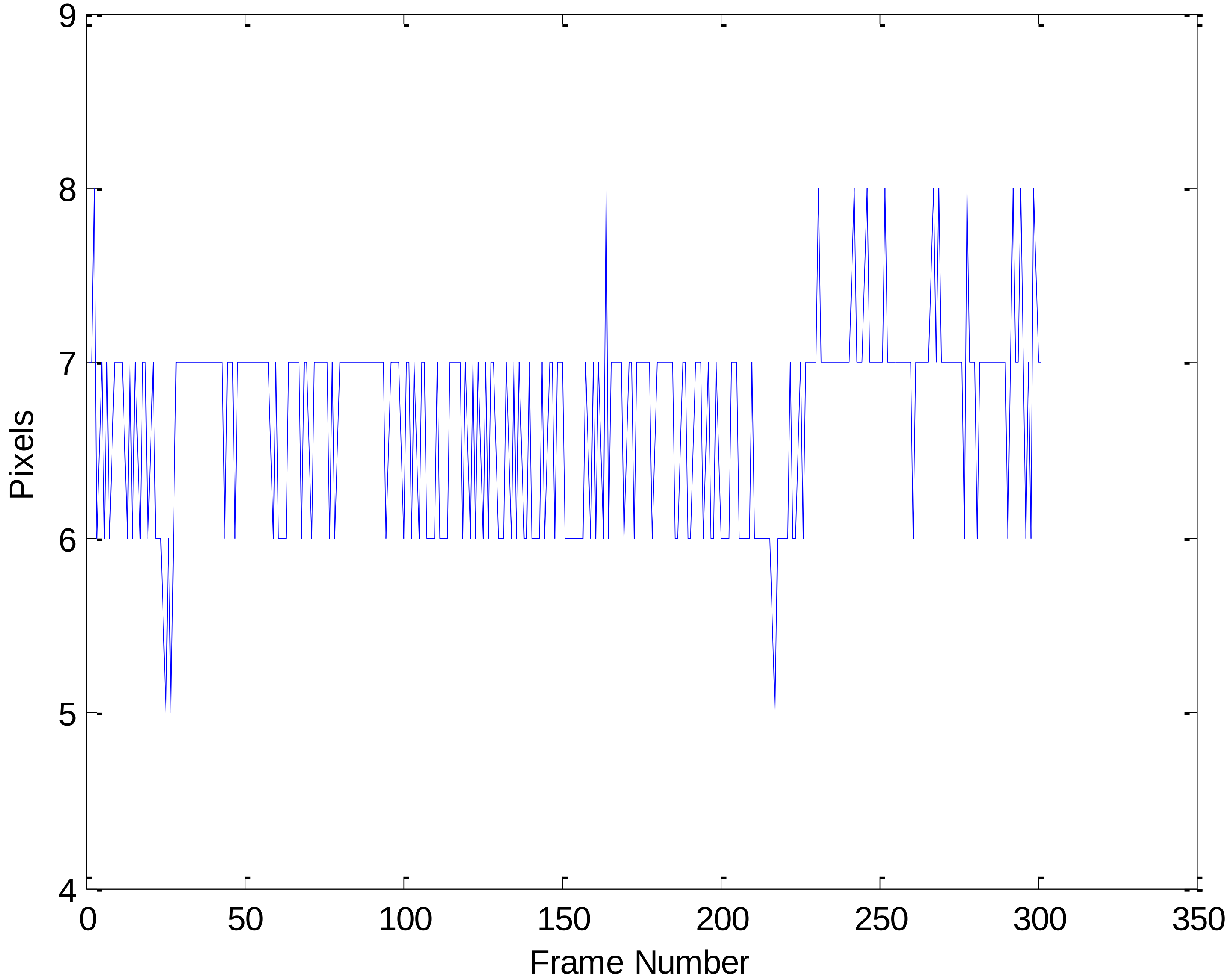


Figure B8: Longitudinal Pixel Shift at 5,000 ft PA / 0.6M (Mojave Airport)

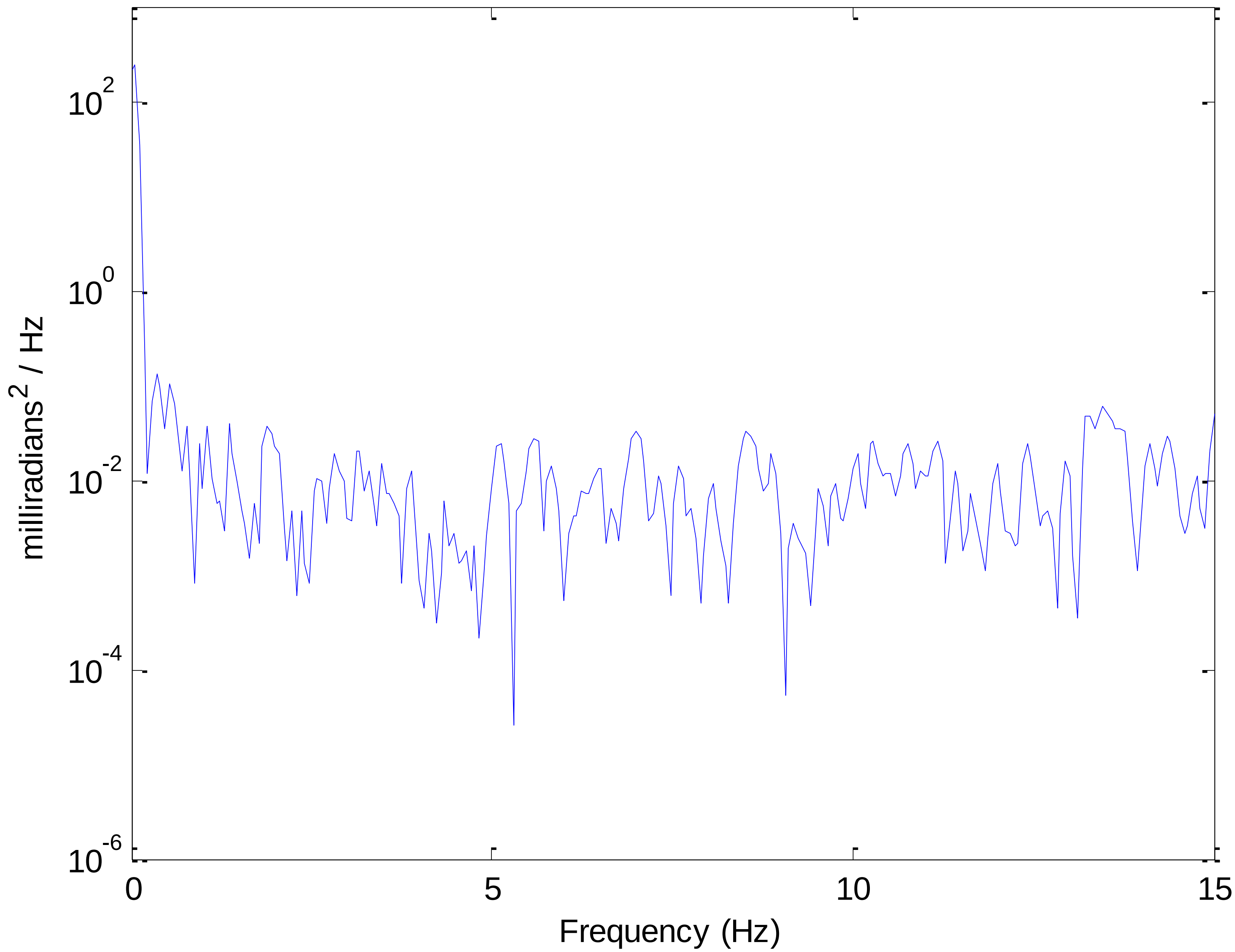


Figure B9: Power Spectral Density of Lateral Image Jitter at 5,000 ft PA / 0.6M (Mojave Airport)

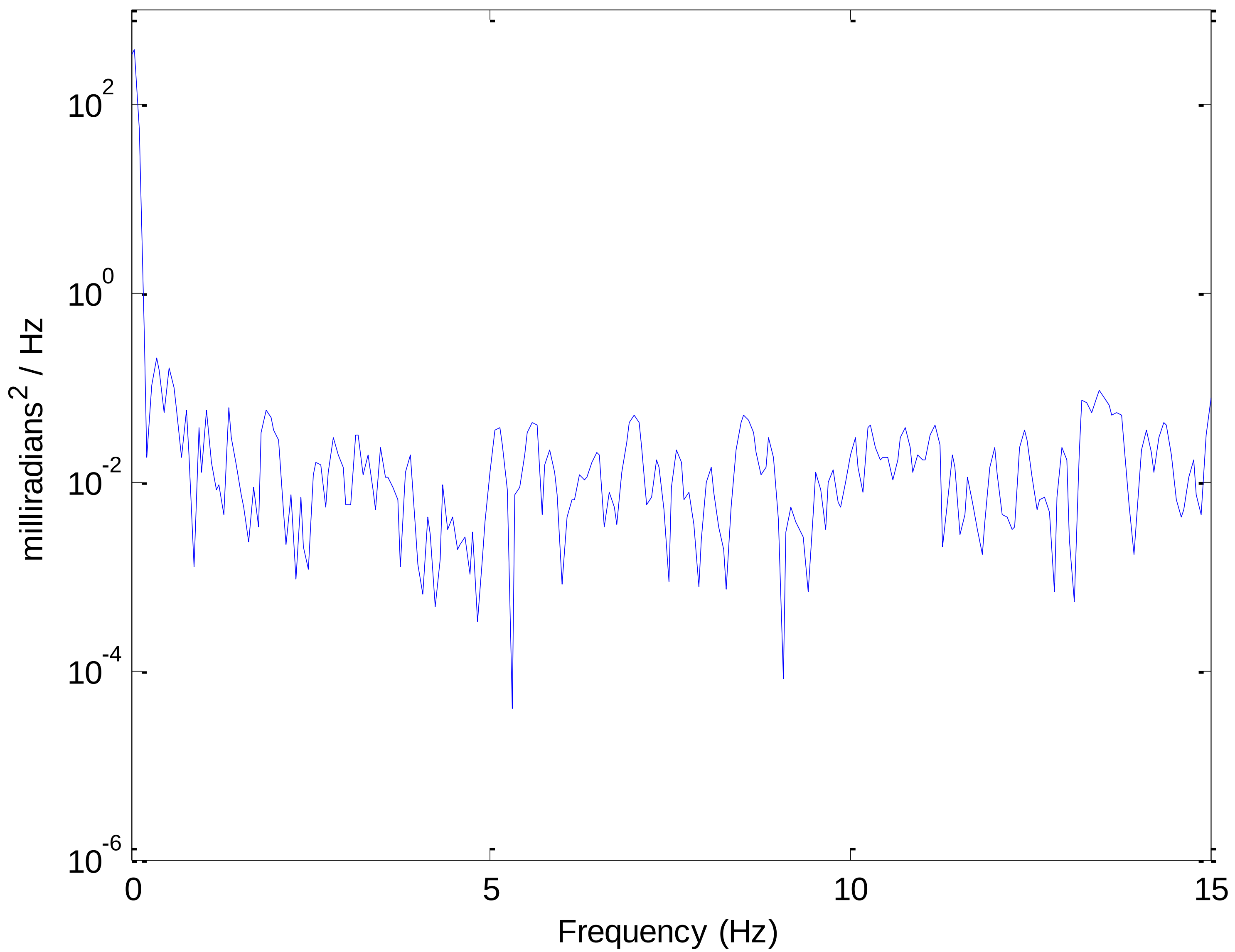


Figure B10: Power Spectral Density of Longitudinal Image Jitter at 5,000 ft PA / 0.6M (Mojave Airport)

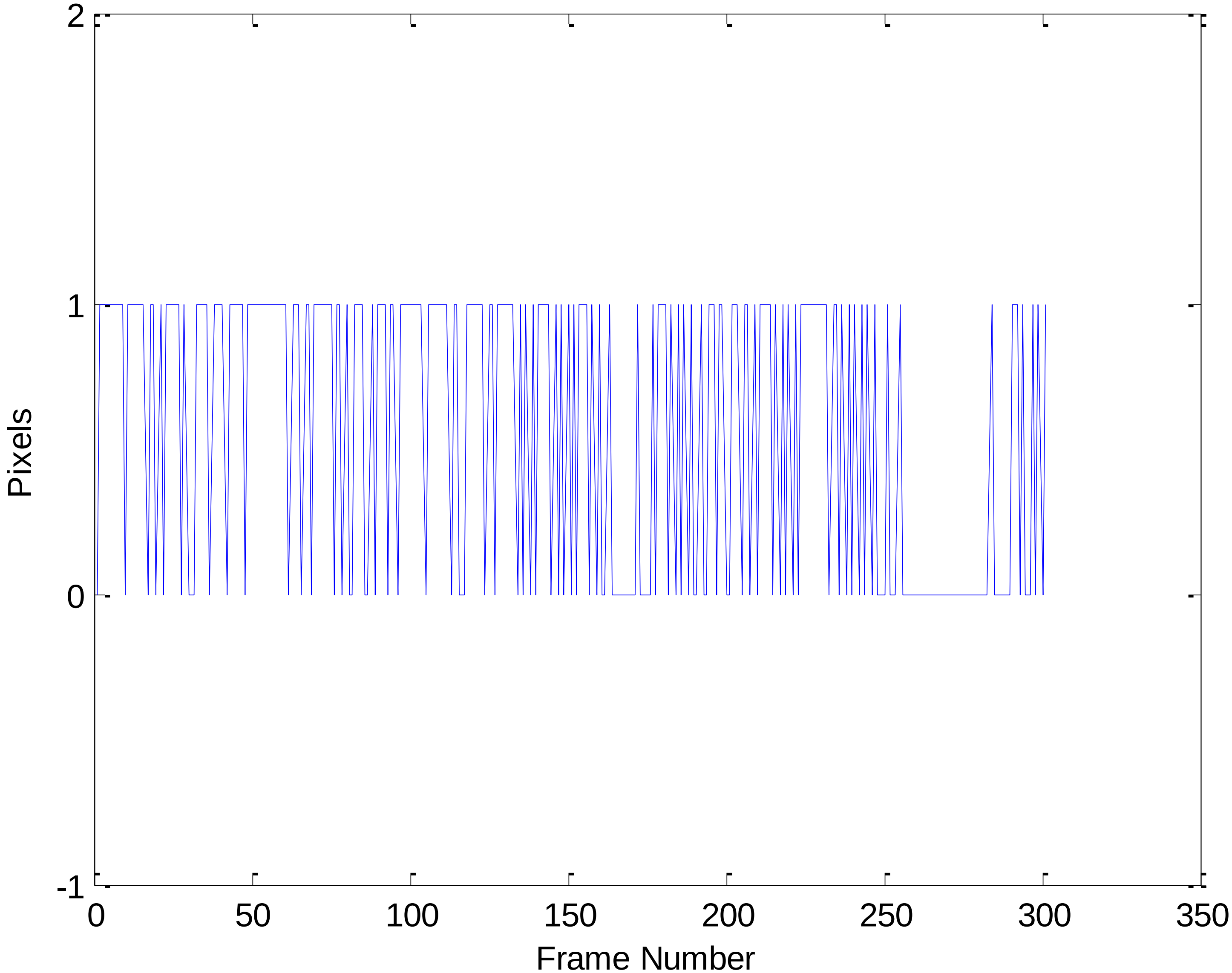


Figure B11: Lateral Pixel Shift at 5,000 ft PA / 0.6M (California City)

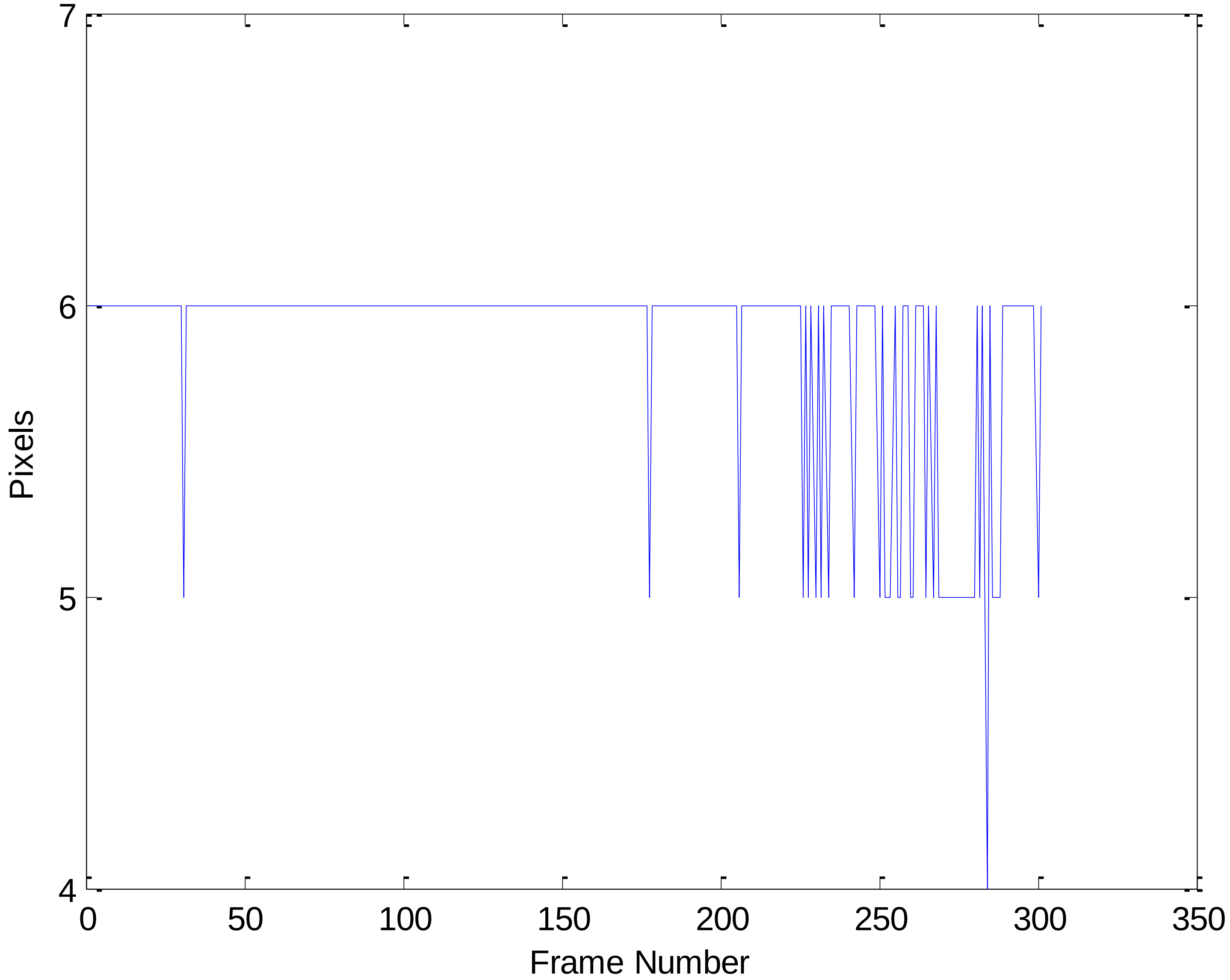


Figure B12: Longitudinal Pixel Shift at 5,000 ft PA / 0.6M (California City)

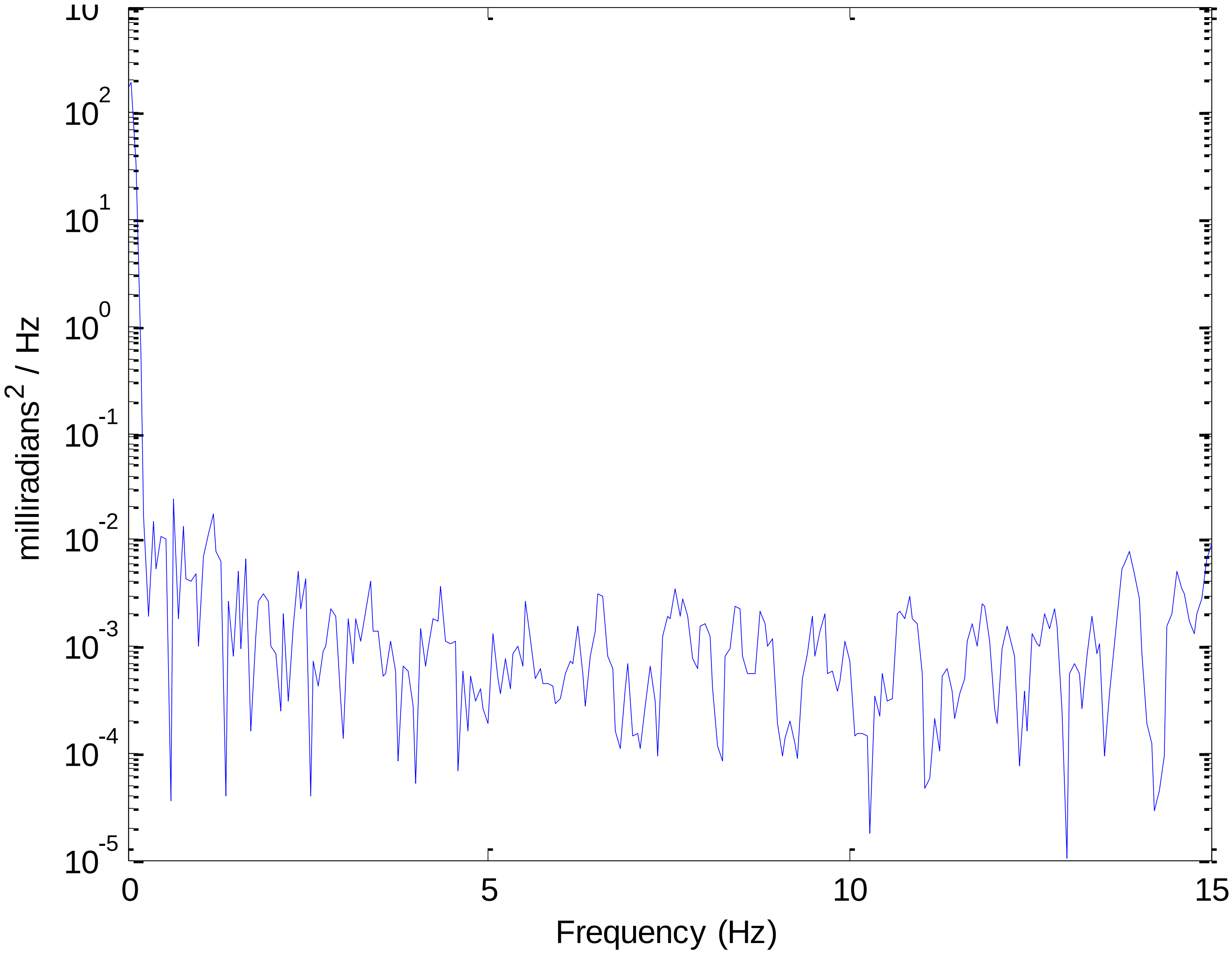


Figure B13: Power Spectral Density of Lateral Image Jitter at 5,000 ft PA / 0.6M (California City)

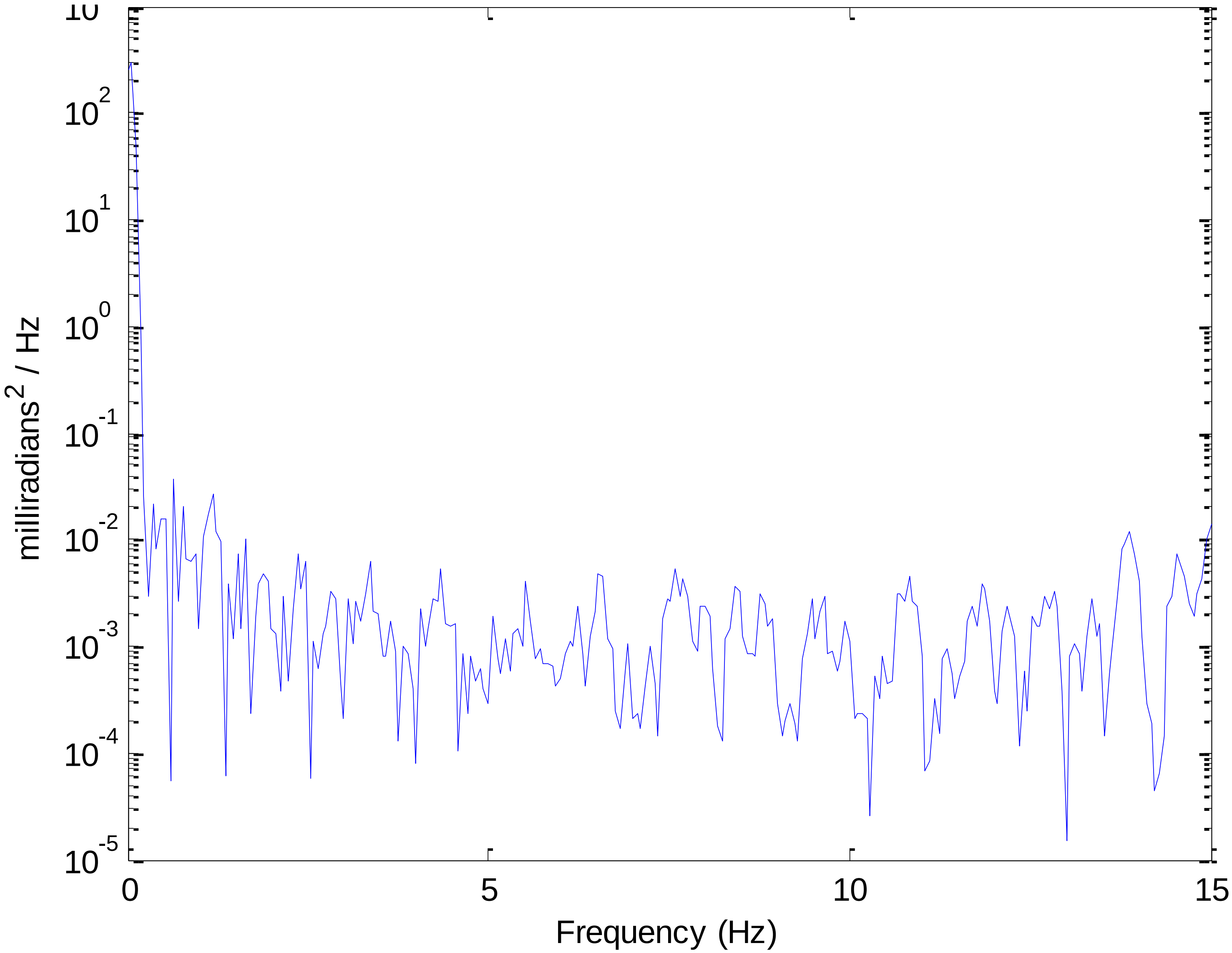


Figure B14: Power Spectral Density of Longitudinal Image Jitter at 5,000 ft PA / 0.6M (California City)

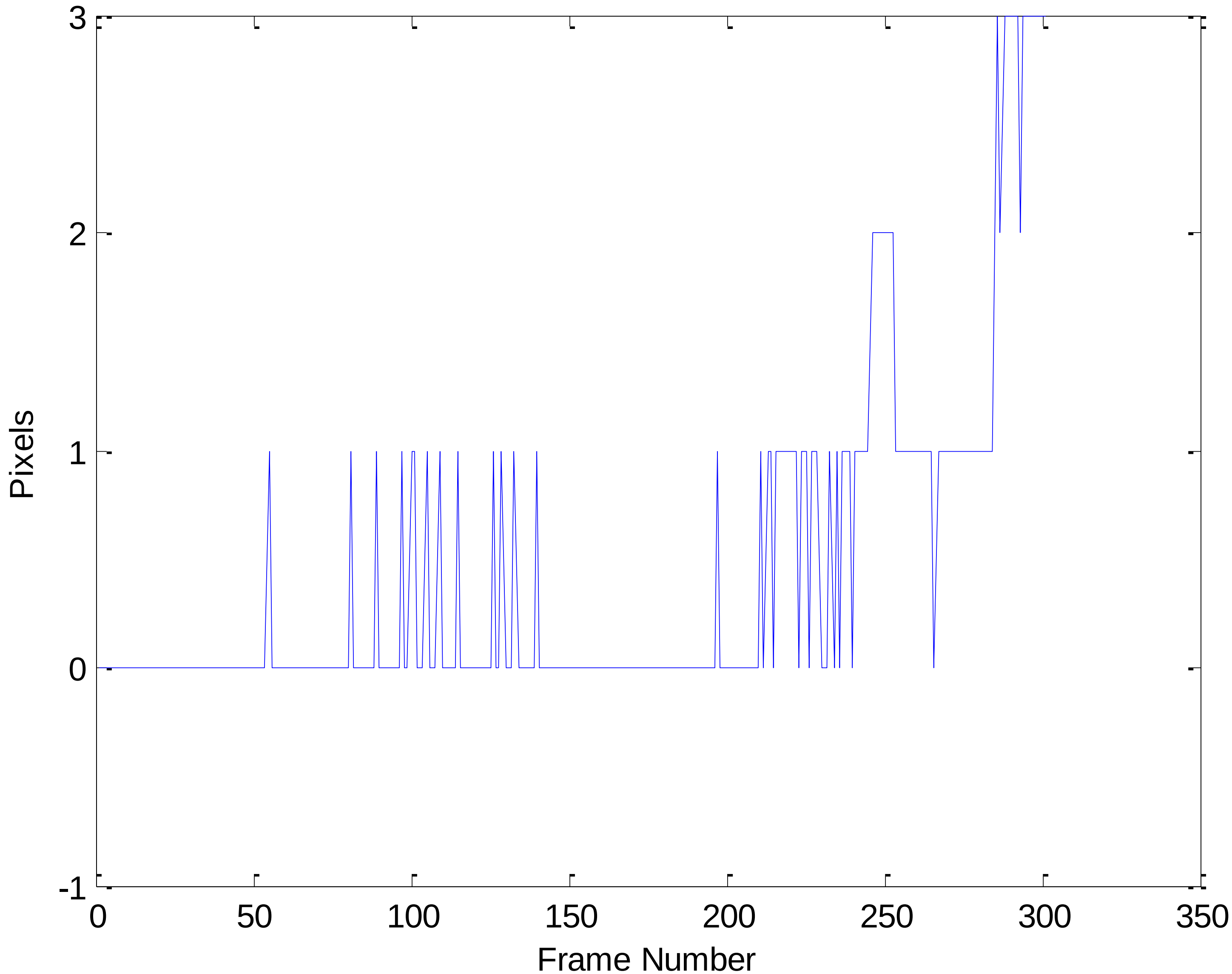


Figure B15: Lateral Pixel Shift at 5,000 ft PA / 0.75M (Mojave Airport)

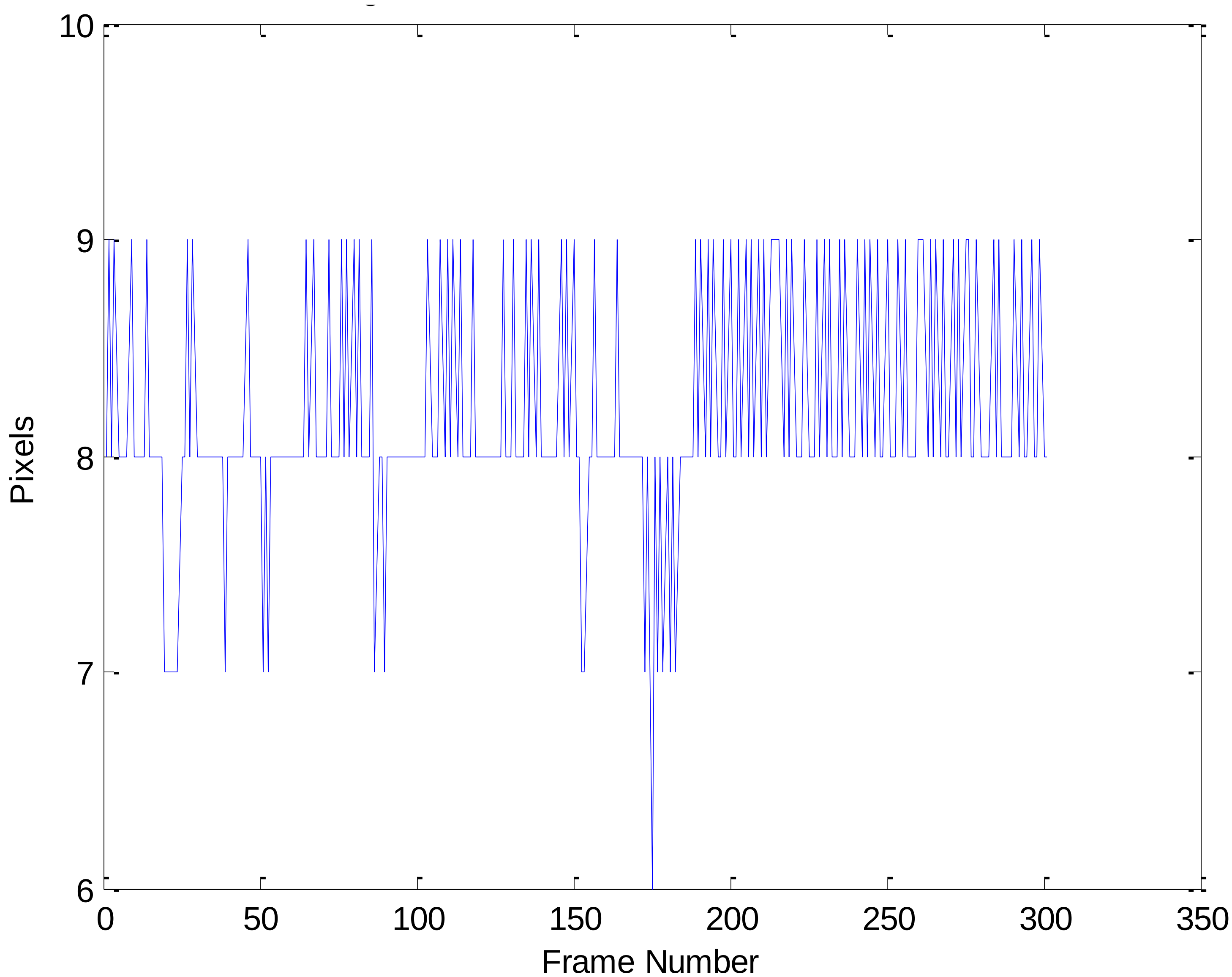


Figure B16: Longitudinal Pixel Shift at 5,000 ft PA / 0.75M (Mojave Airport)

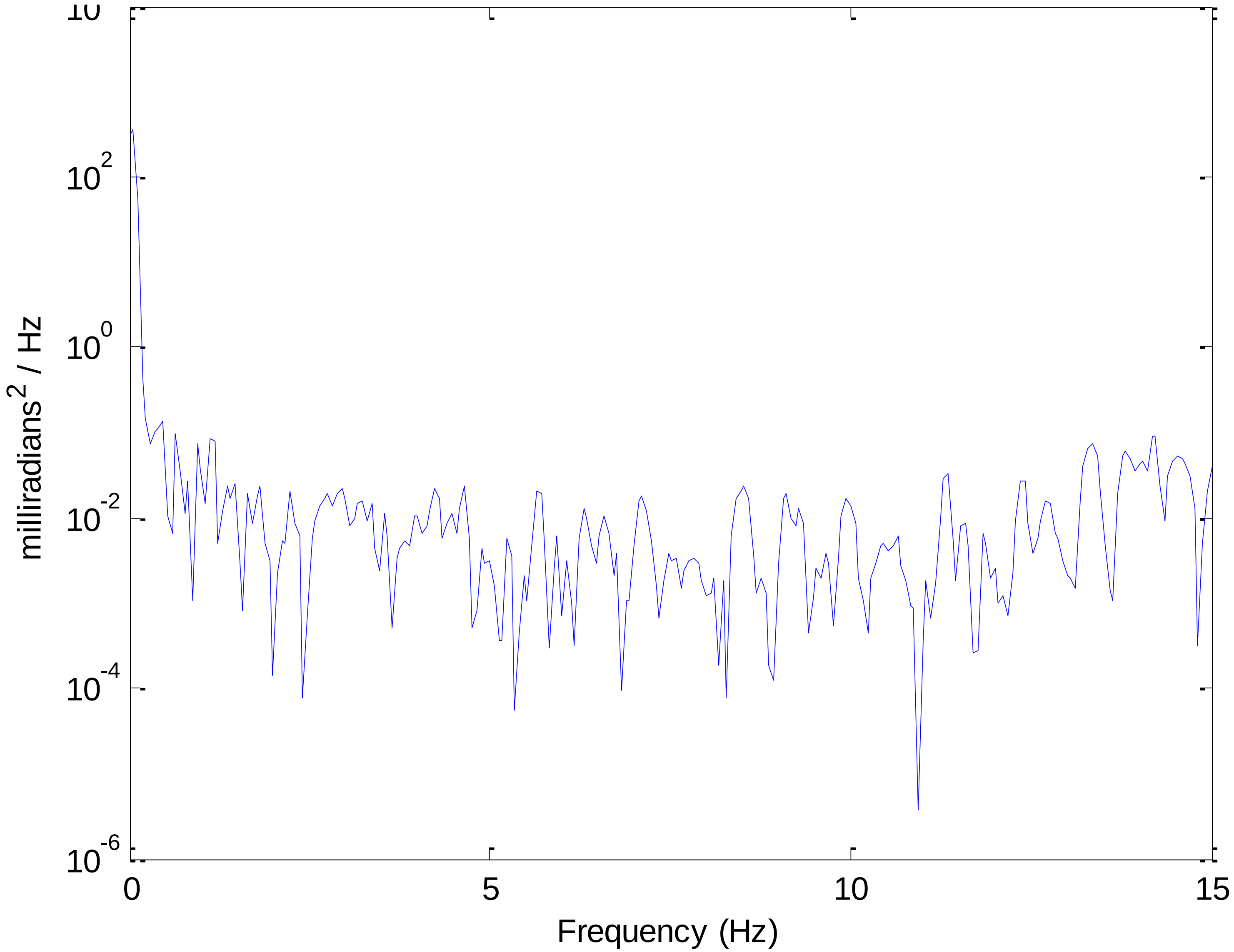


Figure B17: Power Spectral Density of Lateral Image Jitter at 5,000 ft PA / 0.75M (Mojave Airport)

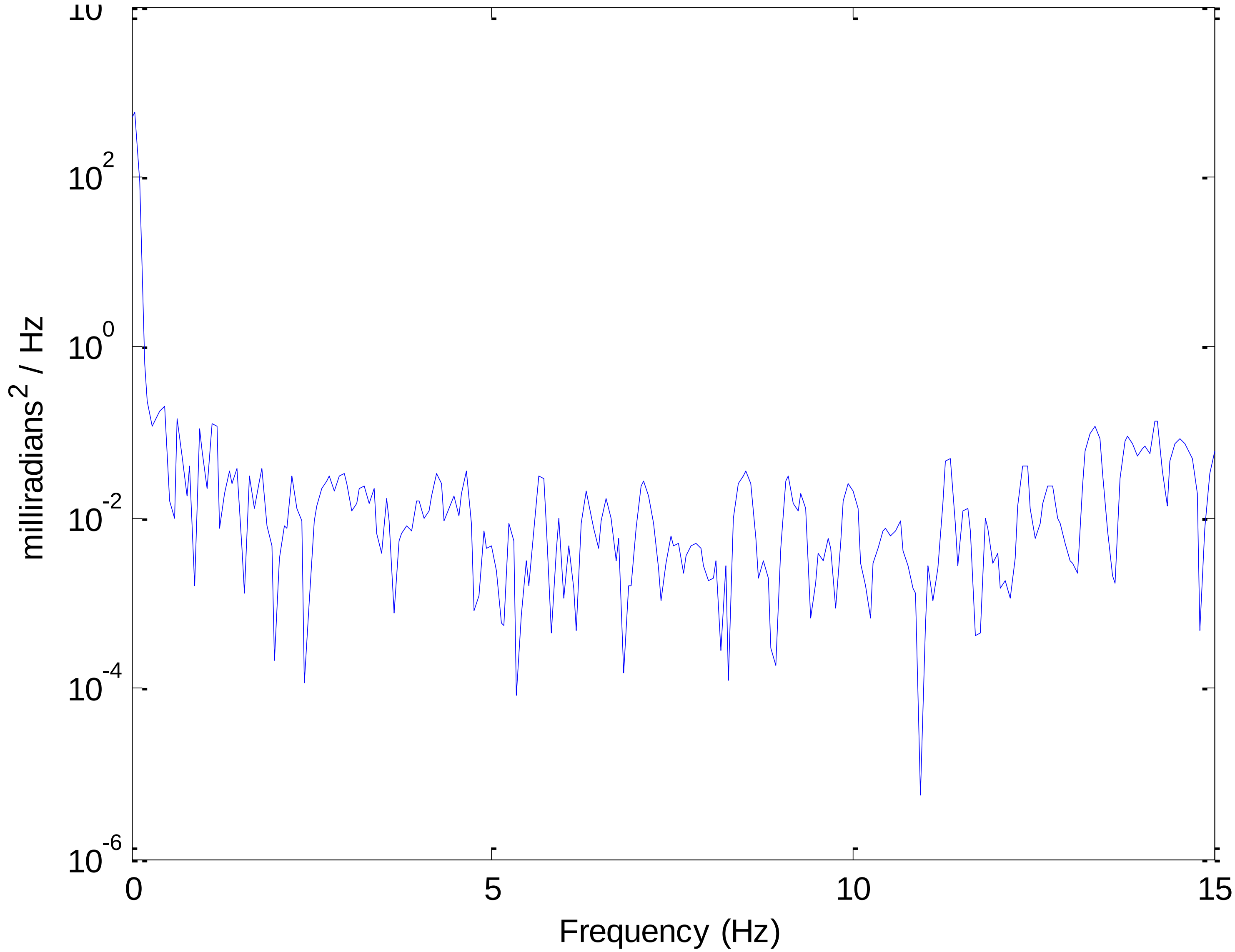


Figure B18: Power Spectral Density of Longitudinal Image Jitter at 5,000 ft PA / 0.75M (Mojave Airport)

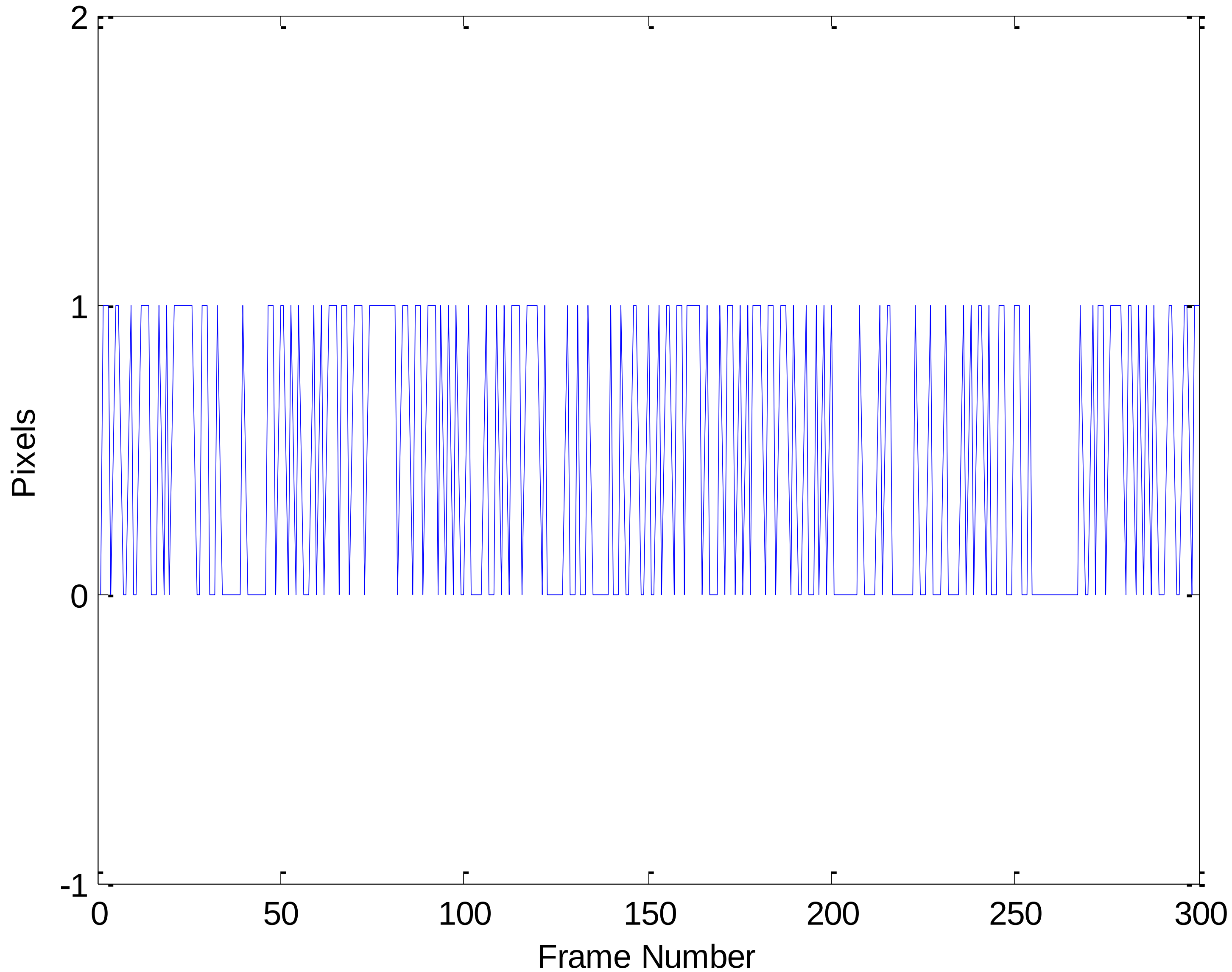


Figure B19: Lateral Pixel Shift at 5,000 ft PA / 0.75M (California City)

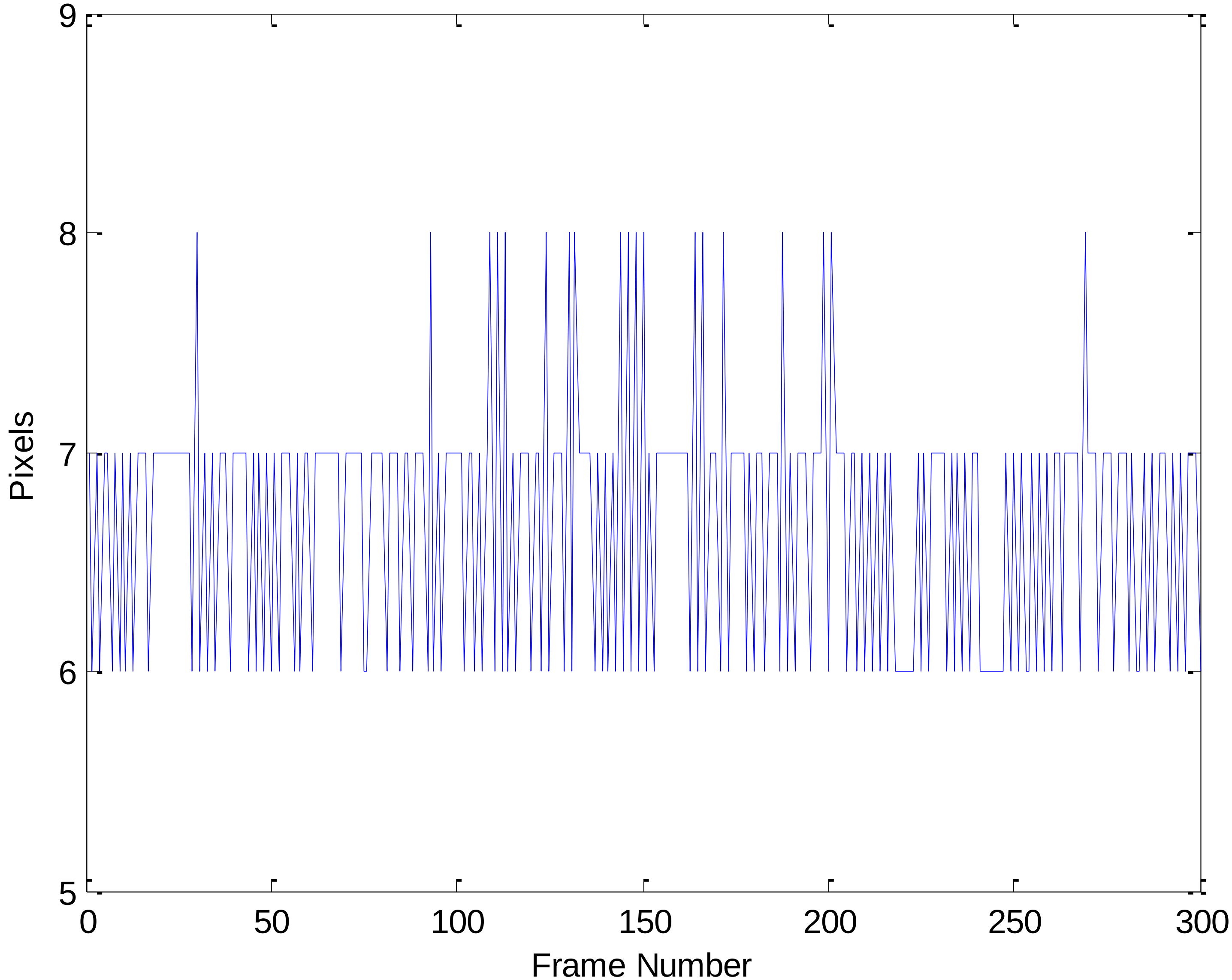


Figure B20: Longitudinal Pixel Shift at 5,000 ft PA / 0.75M (California City)

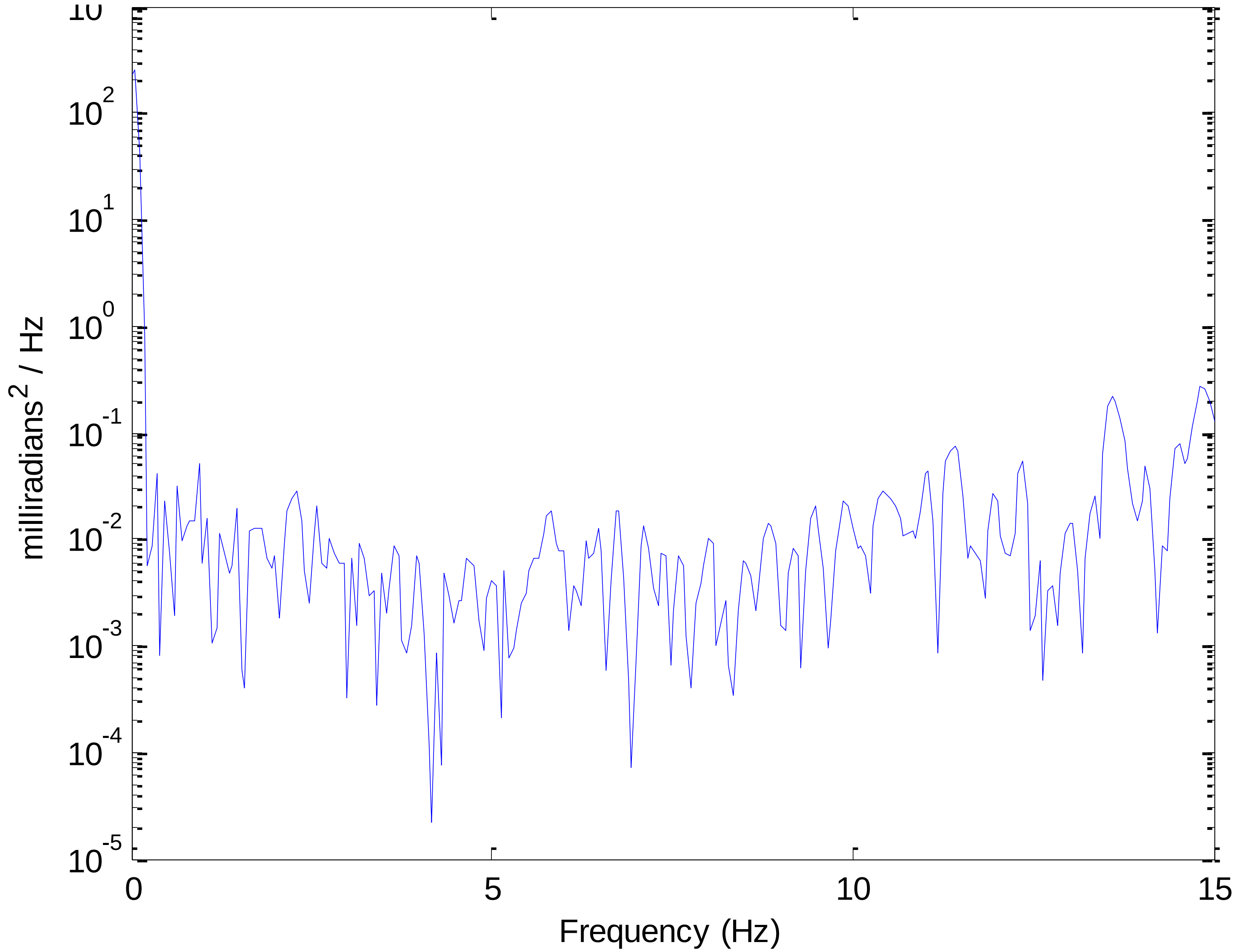


Figure B21: Power Spectral Density of Lateral Image Jitter at 5,000 ft PA / 0.75M (California City)

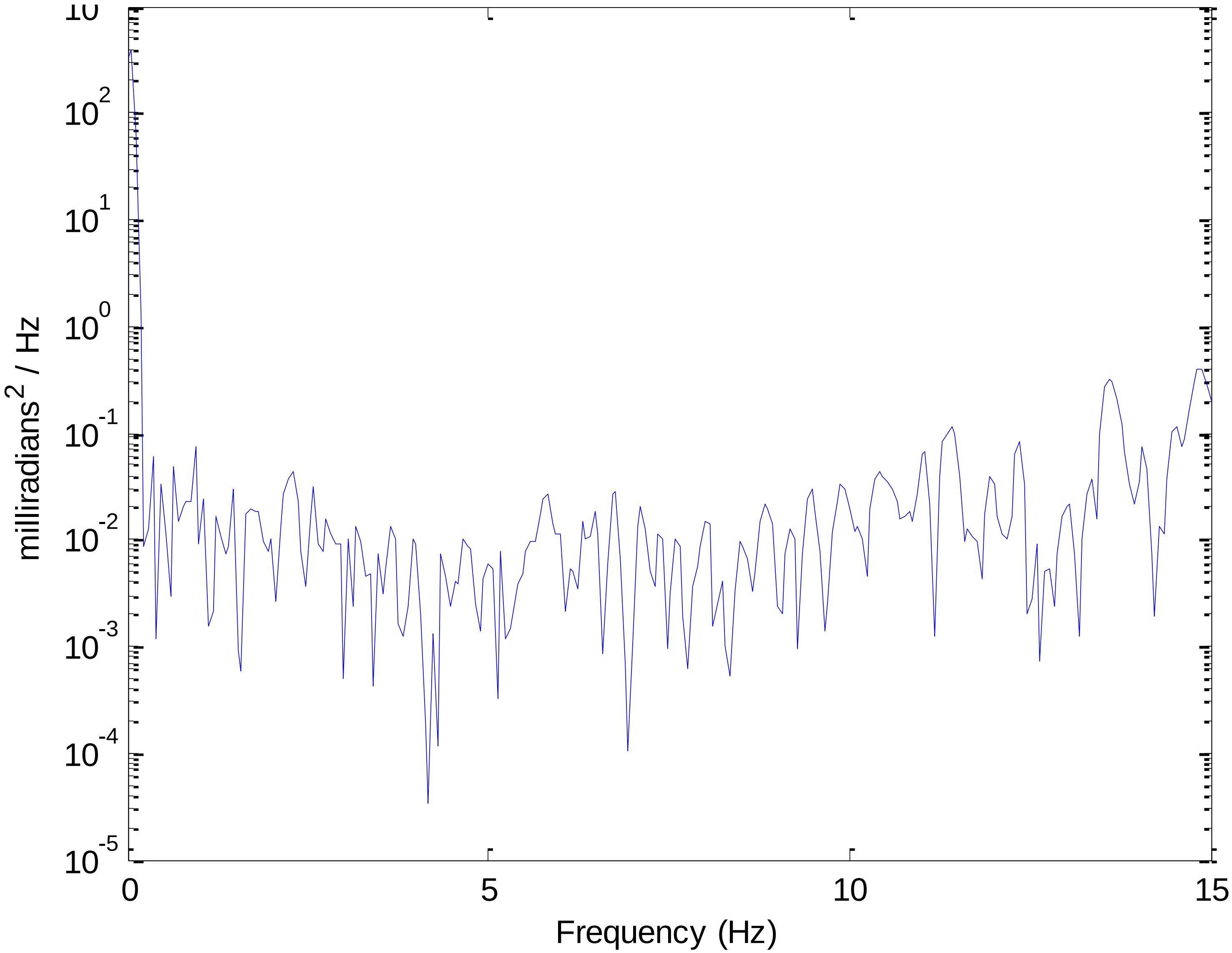


Figure B22: Power Spectral Density of Longitudinal Image Jitter at 5,000 ft PA / 0.75M (California City)

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Appendix C – Pressure Data

This appendix contains analysis and figures of the pressure data collected from the pressure transducer located in the forward compartment of the RASCAL pod. This analysis also used the aircraft recorded pressure ratio (ambient over sea level pressure). These measurements were recorded via telemetry and onboard DAS. Figure C1 illustrates the location of the pressure transducer within the RASCAL pod.

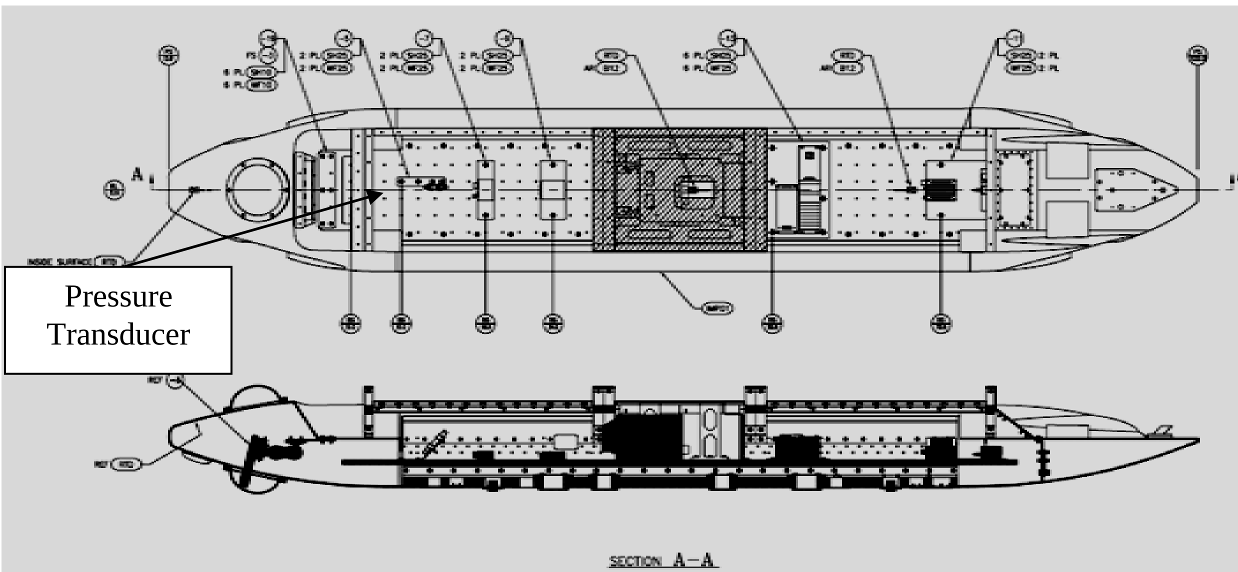


Figure C1: Pressure Transducer Locations

Pressure changes were measured during a rapid descent from 45,000 ft PA to 5,000 ft PA. Data bands and tolerances for these tests are summarized in Table C1.

Parameter	Data Band	Tolerance	Limits
Airspeed (kts)	±10	±10	550 KCAS maximum
Mach number	±0.03	±0.03	1.2M maximum
Altitude (ft)	±1,000	±1,000	500ft AGL minimum, 50,000ft MSL maximum

Table C1: Data Bands and Tolerances for the Pressure Test Points

Figure C2 displays the overall trend that the internal RASCAL pressure very closely tracked the ambient pressure during the rapid descent from 45,000 ft PA to 5,000 ft PA. Pressure altitude is also displayed on figure C2 for informational purposes.

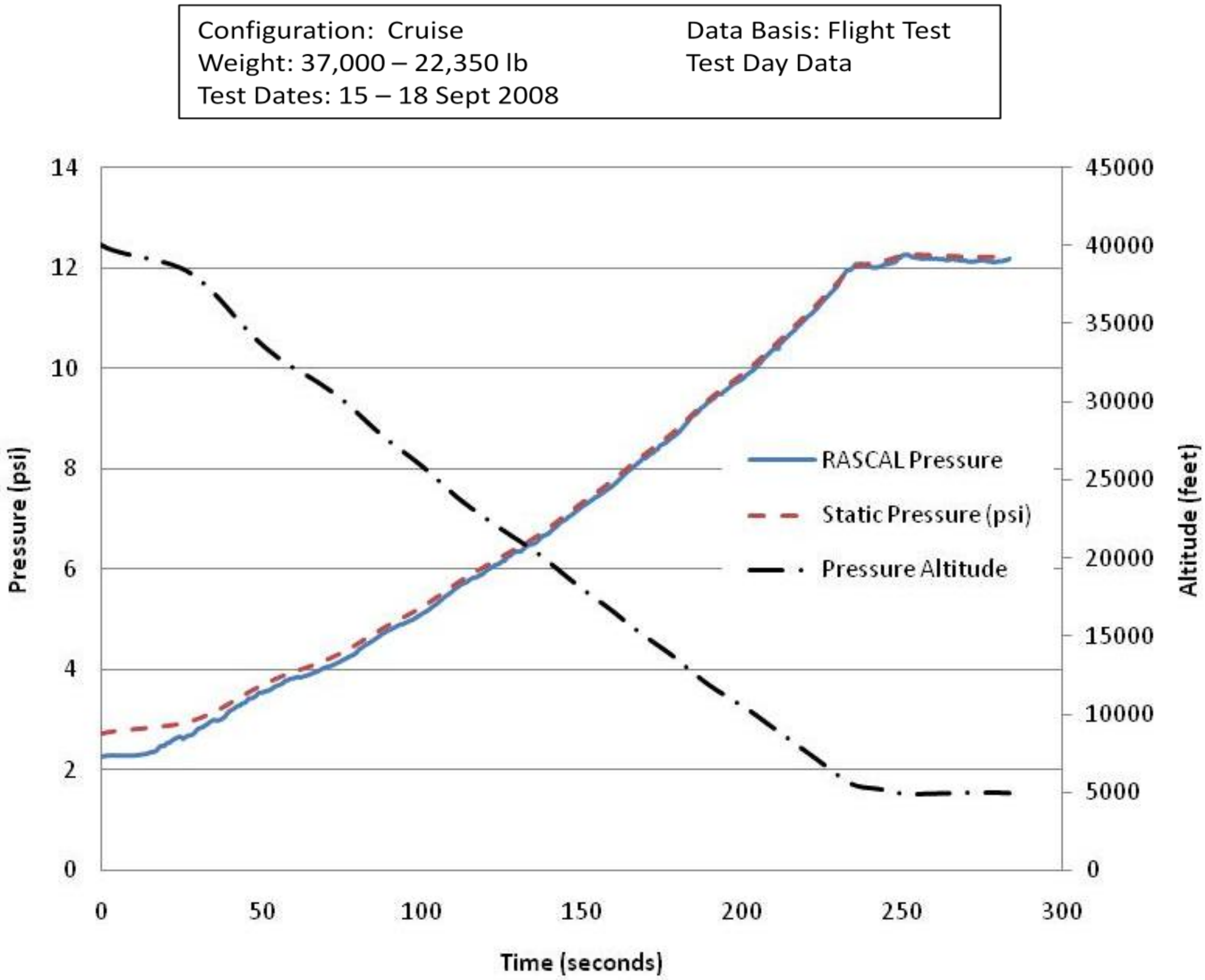


Figure C2: RASCAL Internal and Static (Ambient) Pressure during Penetration Descent

Appendix D – Temperature Data

This appendix contains data analysis and figures of the temperature data collected from the four Resistance Temperature Detectors (RTD) located in the forward, central, and aft compartments of the RASCAL pod. This analysis also used aircraft recorded total temperature and outside aircraft temperature (OAT). These measurements were recorded via telemetry and onboard DAS. Figure D1 illustrates the location of the RTDs within the RASCAL pod. Four RTD temperature probes were located within the forward, central (two), and aft compartments of the RASCAL pod.

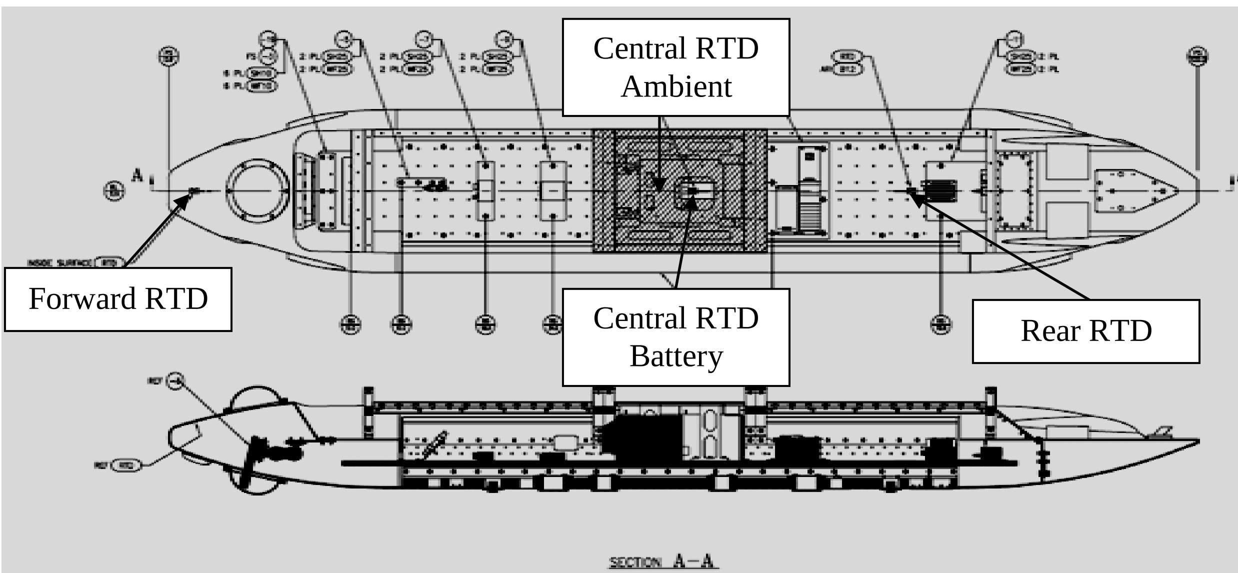


Figure D1. RTD Locations

Temperature measurements were recorded during level accelerations at 5,000, 15,000, 25,000, 35,000, and 45,000 ft PA, a cold soak at 50,000 ft PA, and hot soak at 500 ft PA over Death Valley. Data bands and tolerances for these tests are summarized in Table D1.

Parameter	Data Band	Tolerance	Limits
Airspeed (kts)	±10	±10	550 KCAS maximum
Mach number	±0.03	±0.03	1.2M maximum
Altitude (ft)	±1,000	±1,000	500ft AGL minimum, 50,000ft MSL maximum

Table D1: Data Bands and Tolerances for the Temperature Test Points

Table D2 summarizes the conditions and maximum and minimum temperature readings for each of the test points. The 1g test level accelerations were performed at a rate of 0.01 mach per second from 250 KCAS to the maximum level flight airspeed. The cold soak was performed for 20 minutes at 50,000 ft PA, 0.92 Mach. The hot soak was performed for 20 minutes at 500 ft PA, 525 KCAS over Death Valley. In table D2, the columns “T1 Min” through “T3 Max” are the minimum and maximum temperatures observed in the corresponding RASCAL pod

compartments (T1 = forward, T2 = central, T3 = Aft). The next two columns display the minimum and maximum outside air temperatures and the final two columns show the minimum and maximum total stagnation temperatures during the corresponding level acceleration.

Altitude (ft MSL)	Mach Range	T1 Min	T1 Max	T2 Min	T2 Max	T3 Min	T3 Max	OAT Min	OAT Max	Total Min	Total Max
500	0.88M	60C	73C	40C	55C	42C	58C	55C	55C	75C	78C
5,000	0.4– 0.87M	29C	59C	33C	33C	41C	41C	23C	27C	35C	69C
15,000	0.48-1.03M	13C	43C	22C	23C	28C	30C	-7C	-4C	8C	48C
25,000	0.58-1.17M	28C	30C	28C	30C	34C	38C	-24C	-24C	-9C	38C
35,000	0.74-1.19M	-8C	6C	35C	39C	43C	48C	-43C	-40C	-16C	16C
45,000	0.91-1.17M	-24C	-17C	17C	22C	24C	29C	-59C	-57C	-24C	-7C
50,000	0.92M	-36C	-17C	28C	30C	38C	45C	-65C	-65C	-35C	-35C

Table D2: Flight Conditions for Appendix D Temperature Data Plots

The overall trends for all of test points were that the forward compartment temperature quickly responded to increased total temperature and OAT during level accelerations and the cold and hot soaks. The central and aft compartments responded much slower to changing total temperature and OAT, but did trend towards the forward compartment temperatures. The hot and cold soaks were not flown long enough for the central and aft compartments to reach a steady state temperature, but in both cases the temperatures were still approaching the forward compartment temperature. The following table (Table D3) shows the time to reach 50 percent and 90 percent of the final value for each of the compartments. Since only the front compartment actually reached a final value the assumption was made that the central and rear compartments would reach the same steady state temperature as the front compartment.

Final Value	Forward Time (minutes:seconds)	Center Time (minutes:seconds)	Aft Time (minutes:seconds)
50%	0:43	16:08	13:41
90%	1:17	N/A	N/A

Table D3: Temperature Rate of Change for the Three RASCAL Compartments

The following figures (D1-D5) each plot Mach number against OAT, total temperature and the three RASCAL Pod compartments. There is a plot for each of the level acceleration altitudes (5,000, 15,000, 25,000, 35,000, and 45,000 feet PA).

Figure D2: RASCAL Mach vs. Temperature at 5,000 ft

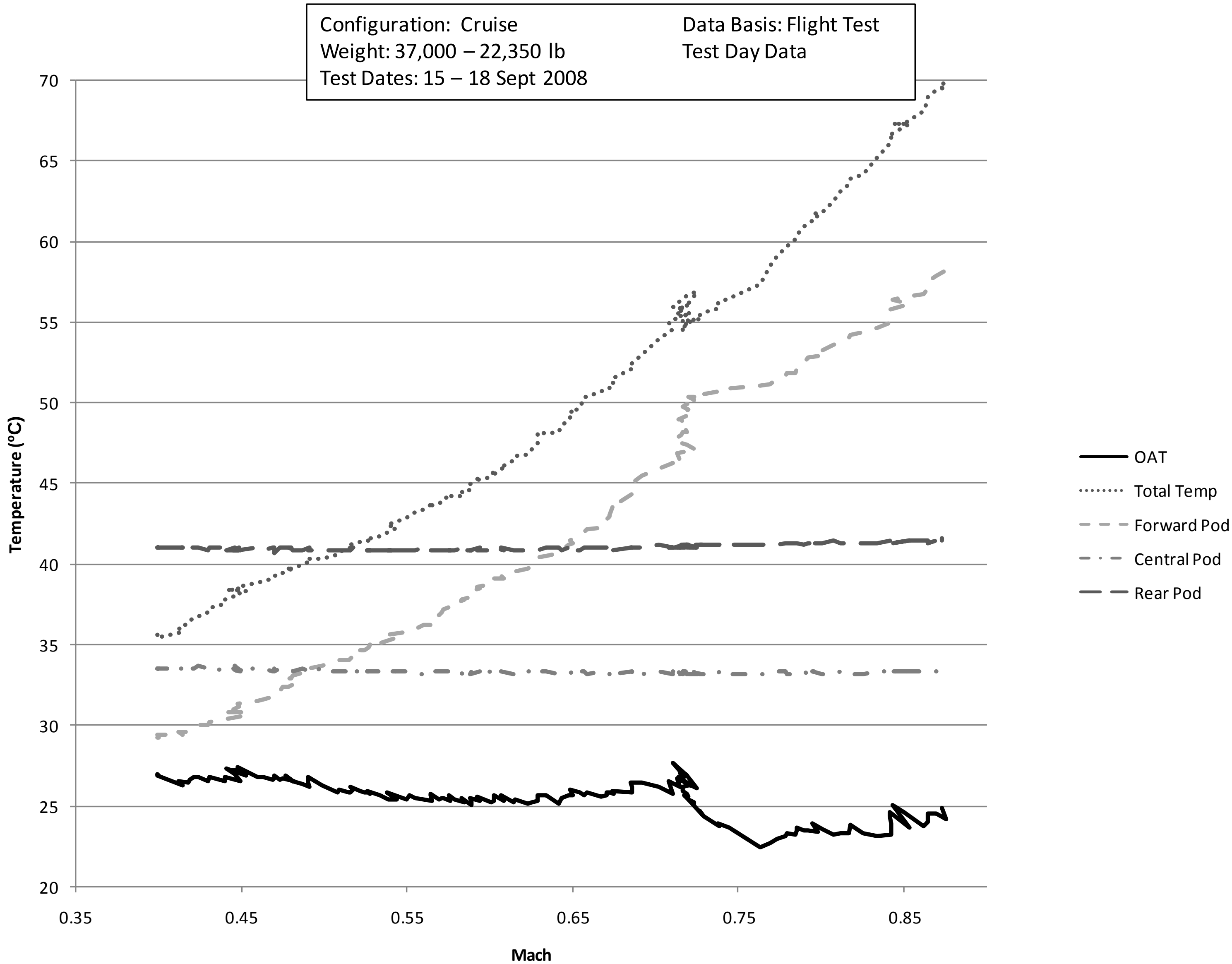


Figure D3: RASCAL Mach vs. Temperature at 15,000 ft

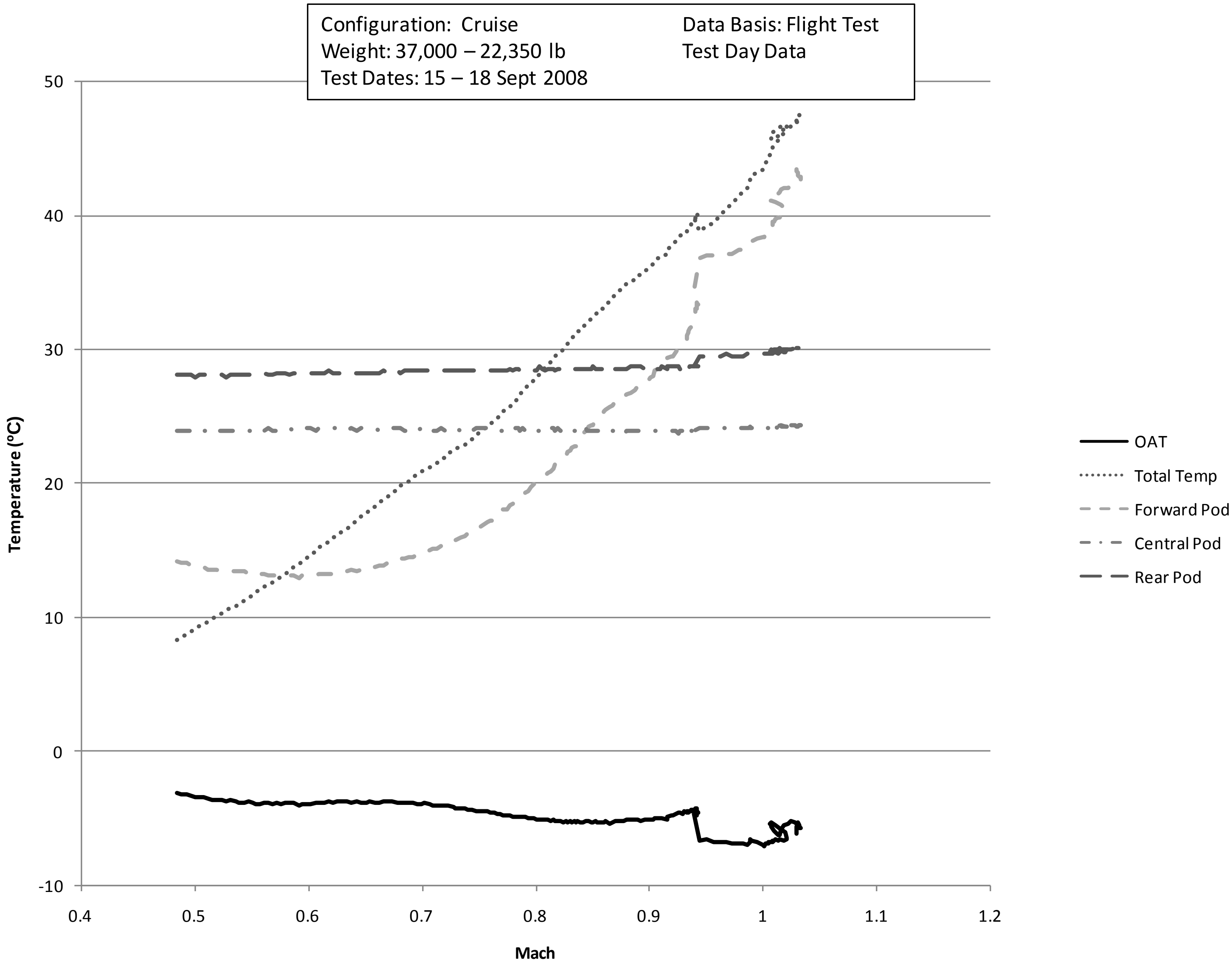


Figure D4: RASCAL Mach vs. Temperature at 25,000 feet

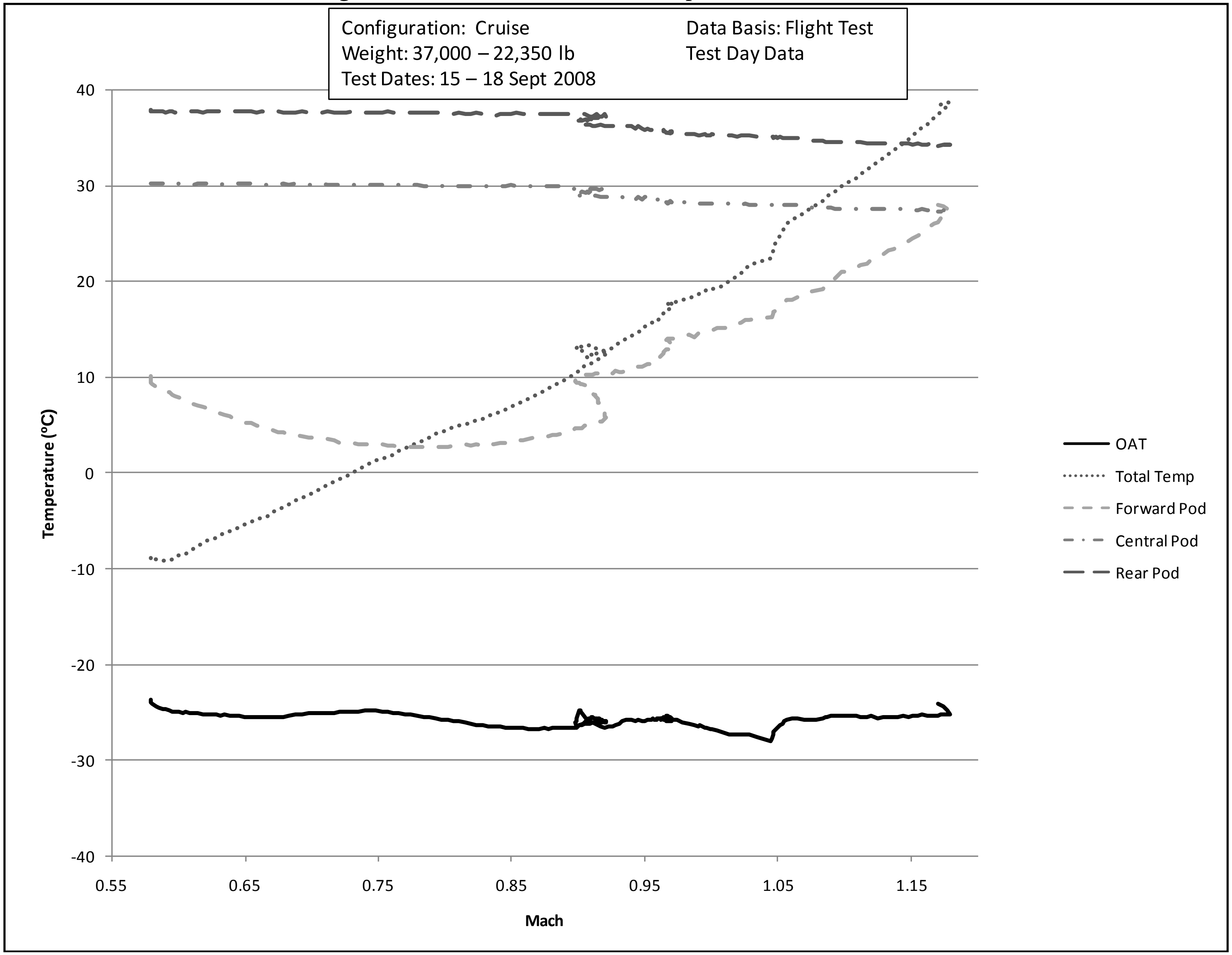


Figure D5: RASCAL Mach vs. Temperature at 35,000 feet

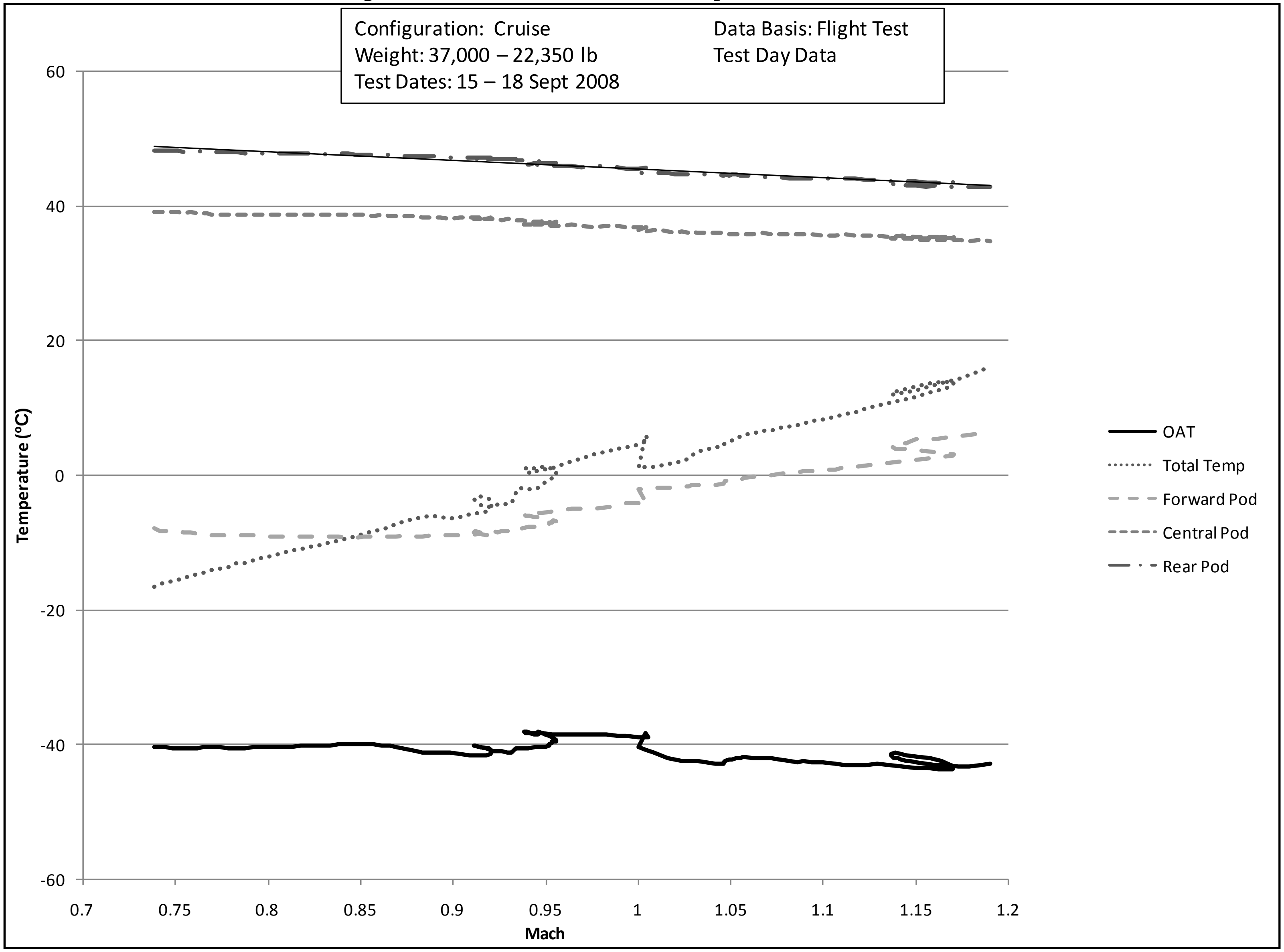
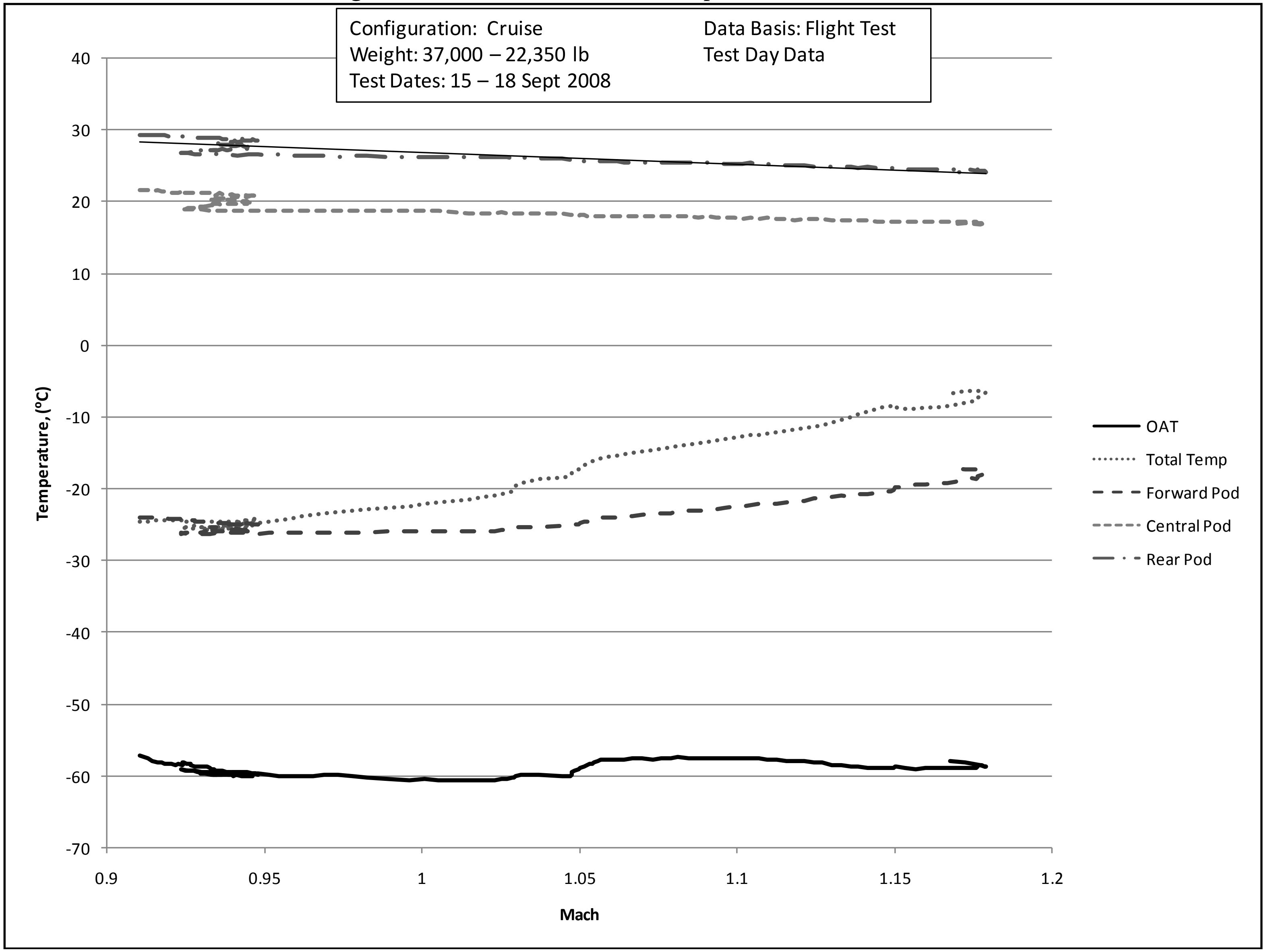


Figure D6: RASCAL Mach vs. Temperature at 45,000 feet



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Appendix E – Air Force Seek Eagle Office Documentation

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 46TH TEST WING (AFMC)
EGLIN AIR FORCE BASE, FLORIDA

MEMORANDUM FOR 412 OG/CC (10 SEP)
USAF TPS/CC (15 SEP)
USAF TPS/DO (15 SEP)
IN TURN

SEP 03 2008

FROM: Air Force SEEK EAGLE Office
205 West D Ave Ste 348
Eglin AFB FL 32542-6865

SUBJECT: Recommended Flight Clearance (RFC) - E0140602-FC01: USAF Test Pilot School (TPS) Reconfigurable Airborne Sensor, Communications and Laser (RASCAL) Pod -5 on F-16C/D Blocks 25-52 Aircraft (Reference: Non-SER Contact (NSC) 06-014A2)

1. This RFC recommends carriage of the USAF TPS RASCAL Pod -5 on F-16C/D Blocks 25-52 aircraft with or without 370-gallon tanks, with or without 300-gallon tanks, 2x2 missile loadings (wingtip CATM-120 and underwing CATM-9 missiles). The specific aircraft/store configurations and flight limitations are included in Atchs 1-3. This RFC is issued in support of the referenced NSC and is the final AFSEO deliverable required to meet the NSC requirements.

2. The following stipulations apply to this RFC:

a. The CONFIG WEIGHT for Atchs 1-3 configurations was calculated with data from STAMP 2988. The RASCAL Pod -5 was mass property measured and must remain within the STAMP 2988 tolerances prior to flight.

b. Drag data for the RASCAL Pod -5 was estimated with SUU-20 data.

c. A successful CFP mission must be accomplished prior to any flights. The CFP mission summary is located at Atch 4.

d. Safety of Flight Ground Test (SOFGT) is required for operation of a single RASCAL Pod -5 prior to first flight on the F-16C/D Blocks 25-52 aircraft (including Block 40/42 CCIP and non-CCIP). Testing was accomplished 25 Jul 08 for the Blocks 25/30/32 and 40/42 CCIP aircraft. The ILS system was not tested and must be monitored for EMI during first flight of the RASCAL Pod -5 on these aircraft while the pod is transmitting. If any EMI is observed, please immediately contact AFSEO EMC. The SOFGT requirement for F-16C/D Block 40/42 non-CCIP and Block 50/52 remains in effect. Please contact the AFSEO EMC Team (POC: Omar Ali, (850) 883-7497 or Dr. Mike Johnson, (850) 882-0970) to discuss or coordinate further Safety of Flight Ground Testing.

e. Safety of Flight Ground Test (SOFGT) is required for dual pod operation prior to first flight on the F-16 Blocks 25-52 aircraft (including Block 40/42 CCIP and non-CCIP). Successfully completing the AFSEO SOFGT with two simultaneously operating pods will clear

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the use of a single pod on the aircraft Block tested. Please contact the AFSEO EMC Team (POC: Omar Ali, (850) 883-7497 or Dr. Mike Johnson, (850) 882-0970) to discuss or coordinate further Safety of Flight Ground Testing.

f. Only operationally representative jets are included in this RFC.

3. This RFC is valid for use with the limitations, rules, and restrictions (including temporary restrictions) stipulated by TO 1F-16C-1-2, TO 1F-16CG-1-2, and TO 1-F-16CM-1-2, dated **15 Oct 07**. Any changes in future updates to these flight manuals that may change the intent of this RFC must not be applied. Due to the timeframe involved in publishing and distributing official copies of these flight manuals, operational units may not have access to pertinent information contained within them.

4. This RFC applies to currently certified stores plus the RASCAL Pod -5 as defined in the Atch 5 STAMP sheet. Approval (written or verbal) from the AFSEO is required prior to scheduling flying missions for any stores whose mass or physical properties deviate from the listed tolerances. Weight and balance calculations are included as Atch 6.

5. Any unexpected or unusual phenomena that occur during the flight program or any modifications made to the aircraft or store, may invalidate this RFC. If either of the above occurs, they must be immediately reported to the AFSEO for evaluation prior to flying any subsequent missions.

6. The risk-level recommendation by the AFSEO to the Safety Review Board (SRB) is **LOW**.

7. This RFC is valid for the duration of the user's requirement, provided that all guidelines/stipulations cited herein are observed. The AFSEO is tracking this RFC and requires notification if modifications are made to the test items or when there is no longer a requirement for this RFC. Our point of contact for this RFC is Lt Curtis Medve, 46 SK/SKP, (850) 882-0943 or DSN 872-0943. The AFSEO loads engineer for the CFP is Mr. Michael Sytsma, 46 SK/SKC, (850) 882-0394 or DSN 872-0394. The TPS point of contact is Lt Col Adam MacDonald, TPS/ED, (661) 277-2125 or DSN 527-2125.

DOUGLAS R. SMITH
Chief, Weapons Certification Division
Air Force SEEK EAGLE Office

6 Attachments:
1. F-16C/D External Stores Limitations Sheet, Blocks 25/30/32
2. F-16C/D External Stores Limitations Sheet, Block 40/42
3. F-16C/D External Stores Limitations Sheet, Blocks 40-52
4. CFP Mission Summary (3)
5. STAMP Data Sheet
6. Weight and Balance Calculations

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Stores Limitations

BLOCKS 25/30/32

GP/STORE	LINE	STATION LOADING LOOKING FORWARD 1	2	3	4	5	6	7	8	9	CARRIAGE MAX KIAS/ MACH	CARRIAGE MAX ACCEL G (1) SYM +/-	CARRIAGE MAX ACCEL G (1) ROLL +/-	LOADING CATEGORY	EMPLOYMENT OR SELECTIVE JETTISON MAX KIAS/ MACH	EMPLOYMENT OR SELECTIVE JETTISON MAX ACCEL G	EMPLOYMENT OR SELECTIVE JETTISON CLIMB/ DIVE ANGLE DEGREES	JETTISON (4) SELECTIVE AUX SPNSN MAX KIAS/ MACH	JETTISON (4) SELECTIVE FUEL TANKS MAX KIAS/ MACH	JETTISON (4) EMERGENCY MAX KIAS/ MACH	DRAG INDEX/ CONFIG WEIGHT (2)	REVERT TO LINE (3)
RASCAL Pod -5	1	(120)	(9) OPT	O		(300)		O OPT	(9) OPT	(120)	550 1.2	7.0 (7.33) -2.5	5.5 -1	III	NA	NA	NA	NA	550 1.2	550 0.9	108 5239	–
	2	(120)	(9) OPT	O	(370)	□ OPT	(370)	O OPT	(9) OPT	(120)		6.5 (7.33) -2.5							450 0.75	450 0.75	162 8820	–

REMARKS:

1. The above lines must be treated as line entries in the 1F-16C-1-2 flight manual. Adhere to all limitations in this TO not specifically addressed in this RFC and to all limitations in applicable Lockheed Martin AEOLs.
2. The "(120)" symbol represents certified CATM-120 missiles only and does NOT represent certified AIM-120 missiles.
3. The "(9)" symbol represents certified CATM-9 missiles only and does NOT represent certified AIM-9 missiles.
4. The "O "symbol represents the RASCAL Pod -5.
5. Tip missiles must be retained.
6. When carrying two RASCAL Pods, only one may be operational until an approved and accepted Safety of Flight Ground Test authorizes use of a second operational pod.
7. Certified AIS/ACMI pod(s) may be substituted for AIM-9 missiles(s) at stations 2 and/or 8.
8. The RASCAL Pod -5 is non-jettisonable. Do not install pyrotechnic cartridges in a MAU-12 ejector rack suspending the RASCAL Pod.

ATCH 1

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Stores Limitations

BLOCK 40/42

GP/STORE	LINE	STATION LOADING LOOKING FORWARD 1	2	3	4	5	6	7	8	9	CARRIAGE MAX KIAS/ MACH	CARRIAGE MAX ACCEL G ① SYM +/-	CARRIAGE MAX ACCEL G ① ROLL +/-	LOADING CATEGORY	EMPLOYMENT OR SELECTIVE JETTISON MAX KIAS/ MACH	EMPLOYMENT OR SELECTIVE JETTISON MAX ACCEL G	EMPLOYMENT OR SELECTIVE JETTISON CLIMB/ DIVE ANGLE DEGREES	JETTISON ④ SELECTIVE AUX SPNSN MAX KIAS/ MACH	JETTISON ④ SELECTIVE FUEL TANKS MAX KIAS/ MACH	JETTISON ④ EMERGENCY MAX KIAS/ MACH	DRAG INDEX/ CONFIG WEIGHT ②	REVERT TO LINE ③
RASCAL Pod -5	1	120	9 OPT	○		300		○ OPT	9 OPT	120	550 1.2	7.0 (7.33) -2	5.0 (5.5) -1	III	NA	NA	NA	NA	550 1.2	550 0.9	108 5239	–
	2	120	9 OPT	○	370	▯ OPT	370	○ OPT	9 OPT	120			4.5 (5.5) -1						450 0.75	450 0.75	162 8820	–

REMARKS:

1. The above lines must be treated as line entries in the 1F-16CG-1-2 flight manual. Adhere to all limitations in this TO not specifically addressed in this RFC and to all limitations in applicable Lockheed Martin AEOLs.
2. The "120" symbol represents certified CATM-120 missiles only and does NOT represent certified AIM-120 missiles.
3. The "9" symbol represents certified CATM-9 missiles only and does NOT represent certified AIM-9 missiles.
4. The "○" symbol represents the RASCAL Pod -5.
5. Tip missiles must be retained.
6. When carrying two RASCAL Pods, only one may be operational until an approved and accepted Safety of Flight Ground Test authorizes use of a second operational pod.
7. Certified AIS/ACMI pod(s) may be substituted for AIM-9 missiles(s) at stations 2 and/or 8.
8. The RASCAL Pod -5 is non-jettisonable. Do not install pyrotechnic cartridges in a MAU-12 ejector rack suspending the RASCAL Pod -5.

ATCH 2

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E0140602-FC01

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Stores Limitations

BLOCKS 40-52

GP/STORE	LINE	STATION LOADING LOOKING FORWARD 1	2	3	4	5	6	7	8	9	CARRIAGE MAX KIAS/ MACH	CARRIAGE MAX ACCEL G (1) SYM +/-	CARRIAGE MAX ACCEL G (1) ROLL +/-	CARRIAGE LOADING CATEGORY	EMPLOYMENT OR SELECTIVE JETTISON MAX KIAS/ MACH	EMPLOYMENT OR SELECTIVE JETTISON MAX ACCEL G	EMPLOYMENT OR SELECTIVE JETTISON CLIMB/ DIVE ANGLE DEGREES	JETTISON (4) SELECTIVE AUX SPNSN MAX KIAS/ MACH	JETTISON (4) SELECTIVE FUEL TANKS MAX KIAS/ MACH	JETTISON (4) EMERGENCY MAX KIAS/ MACH	DRAG INDEX/ CONFIG WEIGHT (2)	REVERT TO LINE (3)
RASCAL Pod -5	1	120	9 OPT	O		300		O OPT	9 OPT	120	550 1.2	7.0 (7.33) -2	5.0 (5.5) -1	III	NA	NA	NA	NA	550 1.2	550 0.9	108 5239	–
	2	120	9 OPT	O	370	▯ OPT	370	O OPT	9 OPT	120			4.5 (5.5) -1						450 0.75	450 0.75	162 8820	–

REMARKS:

1. The above lines must be treated as line entries in the 1F-16CM-1-2 flight manual. Adhere to all limitations in this TO not specifically addressed in this RFC and to all limitations in applicable Lockheed Martin AEOLs.
2. The "120" symbol represents certified CATM-120 missiles only and does NOT represent certified AIM-120 missiles.
3. The "9" symbol represents certified CATM-9 missiles only and does NOT represent certified AIM-9 missiles.
4. The "O"symbol represents the RASCAL Pod -5.
5. Tip missiles must be retained.
6. When carrying two RASCAL Pods -5, only one may be operational until an approved and accepted Safety of Flight Ground Test authorizes use of a second operational pod.
7. Certified AIS/ACMI pod(s) may be substituted for AIM-9 missiles(s) at stations 2 and/or 8.
8. The RASCAL Pod -5 is non-jettisonable. Do not install pyrotechnic cartridges in a MAU-12 ejector rack suspending the RASCAL Pod.

ATCH 3

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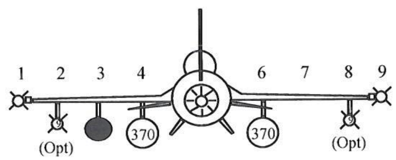
E0140602-FC01

AIRCRAFT/MUNITIONS MISSION SUMMARY	PREPARED BY (Name, office symbol, phone): Michael Sytsma, 46 SK/SKC, DSN 872-0394	DATE: 15 Jul 08	Page 1 of 3 Page(s)
PROJECT TITLE: F-16 Block 30 RASCAL Pod Captive Compatibility Flight Profile (CFP) Flight Test (SEEK EAGLE)	AFSEO PROJECT NO.: E0140602-FC01		

MSN NO. 1

TEST ARTICLES AND CONFIGURATIONS



- CATM-9
- CATM-120
370 - 370 Gallon Fuel Tank
- RASCAL Pod -5

Mirror Image Authorized

Station 1: CATM-120
Station 2: CATM-9 (Opt)
Station 3: RASCAL Pod
Station 4: 370-Gallon Fuel Tank
Station 5: Empty
Station 6: 370-Gallon Fuel Tank
Station 7: Empty
Station 8: CATM-9 (Opt)
Station 9: CATM-120

TEST CONDITIONS

TEST SET	PRESSURE ALT (ft)	MACH	AIRSPEED KCAS	Q* (lb/ft^2)	LOAD FACTOR	MANEUVER	CAT
1	15K	0.90	465*	678	5.6	Wind Up Turn or Symmetric Pull	III
	15K	0.90	465*	678	4.4	Positive-G Loaded Roll (Left and Right)	III
	15K	0.90	465*	678	-2.0	Balanced Symmetric Pushover	III
	15K	0.90	465*	678	-0.8	Negative-G Loaded Roll (Left and Right)	III
2	15K	0.90	465*	678	**7.0**	Wind Up Turn or Symmetric Pull	III
	15K	0.90	465*	678	**5.5**	Positive-G Loaded Roll (Left and Right)	III
	15K	0.90	465*	678	**-2.5**	Balanced Symmetric Pushover	III
	15K	0.90	465*	678	**-1.0**	Negative-G Loaded Roll (Left and Right)	III
3	25K	**1.20**	548*	793	**7.0**	Wind Up Turn or Symmetric Pull	III
	25K	**1.20**	548*	793	**5.5**	Positive-G Loaded Roll (Left and Right)	III
	25K	**1.20**	548*	793	**-2.5**	Balanced Symmetric Pushover	III
	25K	**1.20**	548*	793	**-1.0**	Negative-G Loaded Roll (Left and Right)	III
4	8K	0.94*	**550**	978	**7.0**	Wind Up Turn or Symmetric Pull	III
	8K	0.94*	**550**	978	**5.5**	Positive-G Loaded Roll (Left and Right)	III
	8K	0.94*	**550**	978	**-2.5**	Balanced Symmetric Pushover	III
	8K	0.94*	**550**	978	**-1.0**	Negative-G Loaded Roll (Left and Right)	III
5	6-6.5K	0.88 - 0.91	530 - 548*	920-984	N/A	Speed Soak	III

ADDITIONAL REQUIREMENTS

- Pre- and Post-Flight Structural Check Required with RASCAL on A/C
- HUD Video Desired
- Same Pilot Desired

ENDPOINTS

Airspeed: **550 KCAS**
Mach: **1.20**
Load Factor:
7.0/-2.5 G SYM
5.5/-1.0 G ROLL
CAT: **III**

* approximate values, for reference only
Note 1: Bolded table values signify endpoints.

TEST CONDITION TOLERANCES:
1. Airspeed (KCAS): +/-20 KCAS, except at end points where tolerance is +0/-20 KIAS.
2. Mach: +/-0.02M, except at end points where tolerance is +0/-0.02M.
3. Altitude (ft MSL): +/-2000 ft except for speed soaks. Speed soak altitude band is as specified above.
4. Load Factor (G): +/-0.5 g's, except at end points where tolerance is +0/-0.5 g's when doing positive maneuvers and -0/+0.5 g's for negative maneuvers.

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AIRCRAFT/MUNITIONS MISSION SUMMARY	PREPARED BY (*Name, office symbol, phone*) Michael Sytsma, 46 SK/SKC, DSN 872-0394	DATE 15 Jul 08	*Page* 2 *of* 3 *Page(s)*
PROJECT TITLE F-16 Block 30 RASCAL Pod Captive Compatibility Flight Profile (CFP) Flight Test (SEEK EAGLE)		AFSEO PROJECT NO. E0140602-FC01	

MISSION DETAILS

CAPTIVE COMPATIBILITY FLIGHT PROFILE:

1. Conduct the specified maneuvers using the “Procedures for Conducting SEEK EAGLE Captive Compatibility Flight Profile (CFP) Tests” as a guide. Only the maneuvers specified on this sheet need be performed.

2. Conduct a captive compatibility flight test as specified by **MIL-HDBK-1763A**, Test 252 and 253. Use **MIL-HDBK-244A, Sections 6.2.1.7.6 thru 6.2.1.7.9** as a guide.

NOTES:

1. F-16 Block 30 Aircraft Required.

2. The minimum total flight time of the mission shall be 1.5 hours as specified by MIL-HDBK-244 para 6.2.1.7.8 to ensure complete structural evaluation. **If more than one sortie is required to perform the test, the RASCAL pod <u>may not</u> be downloaded between sorties.**

3. The Speed Soak may be performed at any time during the mission and may be performed in intervals. The minimum cumulative flight time for the speed soak is 30 minutes.

4. Vary Mach number within 0.88 to 0.91 to find maximum apparent vibration levels during the speed soak. Remain at Mach number with maximum apparent vibration level.

5. SEEK EAGLE Engineering must perform a pre- and post-flight inspection of the RASCAL pod while still on the aircraft.

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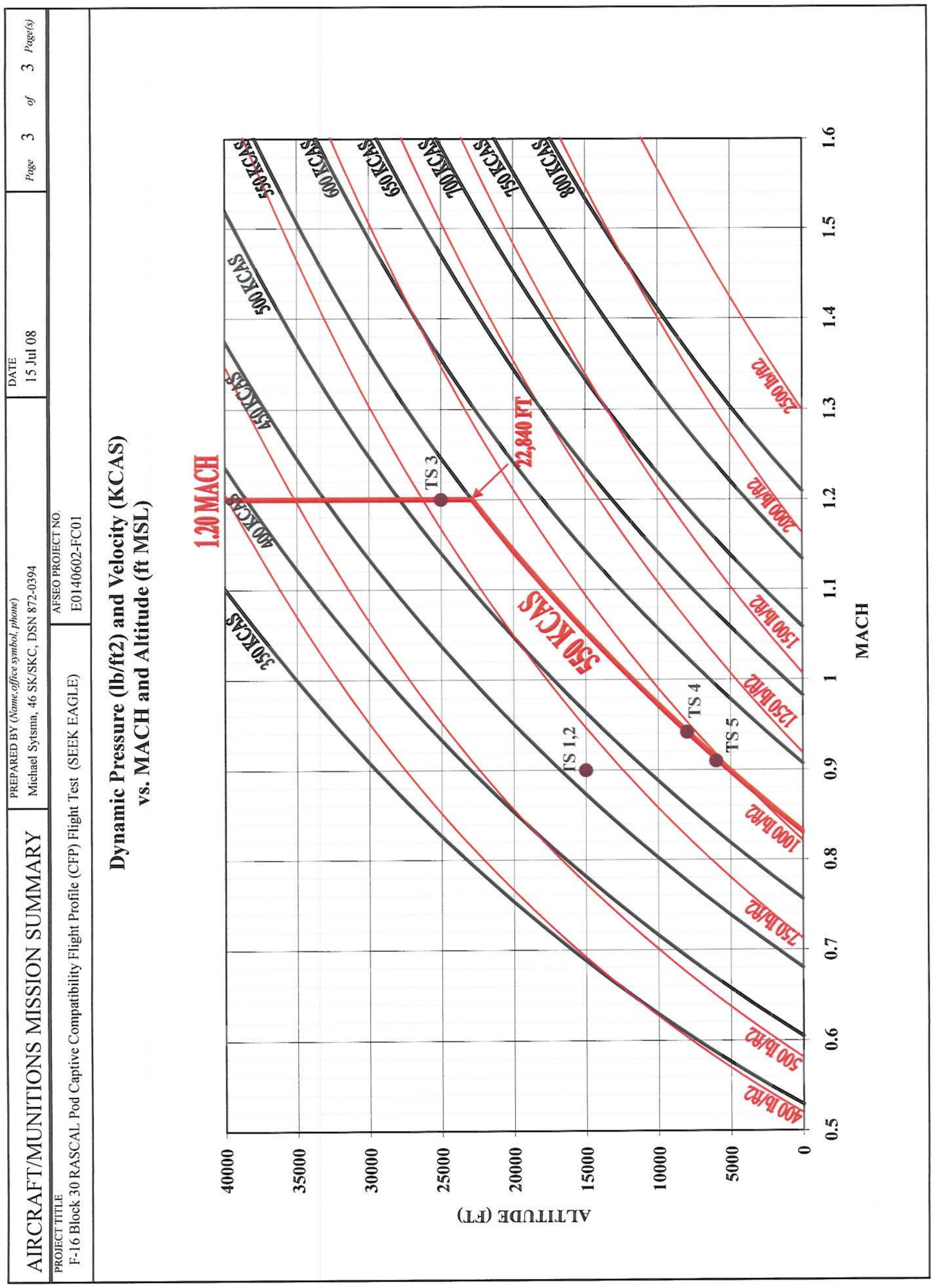
AIRCRAFT/MUNITIONS MISSION SUMMARY
PREPARED BY (Name, office symbol, phone)
Michael Sytsma, 46 SK/SKC, DSN 872-0394
DATE
15 Jul 08
Page 3 of 3 Page(s)
PROJECT TITLE
F-16 Block 30 RASCAL Pod Captive Compatibility Flight Profile (CFP) Flight Test (SEEK EAGLE)
AFSEO PROJECT NO.
E0140602-FC01
Dynamic Pressure (lb/ft2) and Velocity (KCAS)
vs. MACH and Altitude (ft MSL)
ALTITUDE (FT)
MACH
1.20 MACH
22,840 FT
550 KCAS
TS 1,2
TS 3
TS 4
TS 5
350 KCAS
400 KCAS
450 KCAS
500 KCAS
550 KCAS
600 KCAS
650 KCAS
700 KCAS
750 KCAS
800 KCAS
400 lb/ft2
500 lb/ft2
750 lb/ft2
1000 lb/ft2
1250 lb/ft2
1500 lb/ft2
2000 lb/ft2
2500 lb/ft2
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STORE TECHNICAL AND MASS PROPERTIES DATA

DATE OF LAST REVISION: 22-Aug-08

NOMENCLATURE: NAME **RASCAL POD** MODEL **-5**

COMMON NAME: RASCAL W/DAS

DESCRIPTION: RECONFIGURABLE AIRBORNE SENSOR, COMMUNICATION AND LASER (RASCAL) POD W/DATA ACQUISITION SYSTEM (DAS) — RMK 1

STAMP STORE NUMBER: 2988

STAMP CATEGORY / SUBCATEGORY: 2D - Miscellaneous Instrumentation Pods

STORE STATUS: UNIQUE

REFERENCE DOCUMENT / DRAWING: (1) USAF TEST PILOT SCHOOL DOCUMENT, "CERTIFICATION DATA PACKAGE FOR THE RECONFIGURABLE AIRBORNE SENSOR, COMMUNICATIONS AND LASER (RASCAL) POD", — RMK 2

LOCATION OF FWD SUSPENSION POINT CENTERLINE (INCHES AFT OF NOSE): 46.05 — RMK 3

DATA CREDIBLITY: MEASURED — # SAMPLES: 1 — RMK 3

LENGTH (INCHES): 122.00 — RMK 3

HEIGHT (INCHES): 12.06 — RMK 3

WIDTH (INCHES): 19.30 — RMK 3

SUSPENSION SPACING (INCHES): 30.0 — RMK 3

FIN # / NOMENCLATURE: N/A

FIN SPAN (INCHES): N/A

FIN ANGLE FROM LUG AXIS (DEG CLOCKWISE VIEWED FROM AFT): N/A

FUZE (NOSE): N/A — (TAIL): N/A — SUBMUNITIONS: N/A

		FULL	EMPTY	TOLERANCE	RMK
WEIGHT (LBS)		375.80	N/A	+/- 5%	3
C OF G (INCHES AFT OF FWD SP PT CL)	X	15.15	N/A	+/- 0.50 IN.	3
C OF G (INCHES RIGHT OF CL REAR VIEW)	Y	0.03	N/A	+/- 0.50 IN.	3
C OF G (INCHES UP FROM CL SIDE VIEW)	Z	1.08	N/A	+/- 0.50 IN.	3
INERTIA (SLUG * FTSQ)	ROLL (IXX)	UNK	UNK	+/- 10%	
INERTIA (SLUG * FTSQ)	PITCH (IYY)	53.91	N/A	+/- 10%	3
INERTIA (SLUG * FTSQ)	YAW (IZZ)	55.33	N/A	+/- 10%	3

REMARKS: (THE NUMBER UNDER A "RMK" IN ANY BLOCK INDICATES ADDITIONAL INFORMATION APPEARS IN THIS SECTION)

1. THE RASCAL POD IS A MODIFIED SUU-20 DISPENSER. THE POD HAS THREE MAIN SECTIONS: FWD, CENTER AND AFT WITH SEPARATE ACCESS PANELS FOR EACH SECTION. THE FWD SECTION IS DESIGNED TO HOUSE UP TO 55.5 POUNDS OF EXPERIMENTAL EQUIPMENT. THE CENTER SECTION CONTAINS SEALED BATTERIES AND A BATTERY CHARGER. THE AFT SECTION CARRIES UP TO 55.5 POUNDS OF PROCESSOR AND TELEMETRY EQUIPMENT. (REFERENCE DOCUMENT NO. 1, PAGE 3.)
2. REF DOC/DWG: REVISION A, DATED 01 AUGUST 2008; (2) UNITED STATES AIR FORCE (CAGE 07870), DWG NO. X20087108, 18 JUL 2008, "BASELINE V AND V CONFIGURATION".
3. MASS PROPERTIES AND PHYSICAL DIMENSIONS OBTAINED FROM MEASUREMENT OF ONE SAMPLE (SN 001), MAP ID #5542, 14 AUG 08.

AFMC FORM Sep-08 4694 **FOR OFFICIAL USE ONLY** Atch 5 (1/1)

Table 1. Moment/Moment Arm Data

Nomenclature	Model	STAMP #	Station	Weight(lbs)	Arm(FS)	Long. MOM/100	Arm(BL)	Lat. MOM/100
RASCAL Pod	-5	2988	3/7	362.2	346.8	1303	120	451

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 46TH TEST WING (AFMC)
EGLIN AIR FORCE BASE, FLORIDA

MEMORANDUM FOR USAF TEST PILOT SCHOOL
ATTN: LT COL ADAM MACDONALD

NOV 18 2008

FROM: Air Force SEEK EAGLE Office (AFSEO)
46 SK/SKP
205 West D Ave Ste 348
Eglin AFB FL 32542-6865

SUBJECT: F-16 RASCAL-5 Pod Captive Compatibility Flight Profile (CFP) Flight Test Results (Reference Non SEEK EAGLE (SER) Contact (NSC) 06-014A2, (RASCAL-5 Pod))

1. This letter documents the results of the AFSEO Captive Compatibility Flight Profile (CFP) flight test for the RASCAL-5 pod. A CFP flight test of a RASCAL-5 pod was conducted on an F-16 Block 30 aircraft at Edwards AFB, CA on 15 Sep 08. The following conditions were achieved: 548 KCAS/1.19 Mach, +7.0/-2.3 G SYM, +5.5/-0.8 G ROLL. The AFSEO concludes that the structural integrity of the RASCAL-5 pod was not compromised during the test. The RASCAL-5 pod successfully passed the CFP test both structurally and functionally.

2. The AFSEO PM for this effort is Lt Juan Ramirez, 46 SK/SKP, (850) 882-0494 or DSN 872-0494. The AFSEO Loads Engineer is Mr. Mike Sytsma, 46 SK/SKC, (850) 882-0394 or DSN 872-0394.

DOUGLAS R. SMITH
Chief, Weapons Certification Division
Air Force SEEK EAGLE Office

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List of Abbreviations, Acronyms and Symbols

AFFTC - Air Force Flight Test Center
AFFTCI - Air Force Flight Test Center Instruction
AFIT - Air Force Institute of Technology
AFSEO - Air Force SEEK EAGLE Office
AMRAAM - Advanced Medium Range Air-to-Air Missile
AOA - Angle of Attack
CATM - Captive Air Training Missile
CFP - Compatibility Flight Profile
DAS - Data Acquisition System
ECM – Electronic Counter Measures
EMI/EMC - Electromagnetic Interference and Electromagnetic Compatibility
FFT - Fast Fourier Transform
HUD - Heads Up Display
IAW - In Accordance With
IADS - Interactive Analysis and Display System
ILLIAD - Instrumentation, Loading, Integration, Analysis and Decommutation
KCAS – Knots Calibrated Airspeed
KEAS – Knots Equivalent Airspeed
OAT - Outside Air Temperature
PIRA - Precision Impact Range Area
PA – Pressure Altitude
PAR - Project Assessment Reports
PRR - Preliminary Report of Results
PSD - Power Spectral Density
RASCAL - Reconfigurable Airborne Sensor, Communications and Laser
RFC - Recommended Flight Clearance
RMS – Root Mean Squared
RSS - Root Sum Squared
RTD - Resistance Temperature Detectors
SMS – Stores Management System
SUU - Suspension Utility Unit
TM - Telemetry
TMP - Test Management Project
TPS - Test Pilot School
TS - Technical Support